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PERSISTENT ALBUMINURIA AND GLYCOSURIA, WITH FREQUENT HYALINE CASTS, IN FUNCTIONAL NERVOUS DISEASES.[1]

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For many years, in the fear that I might overlook some lurking renal trouble, I have been in the habit of having examinations of the urine made in cases of neurasthenia and other cases of functional disease that have sought my advice; and in especial the difficulty of treatment of many of the neurasthenics has led me, within the past two years, to very careful testing with the hope that I might therefrom derive indications for a rational therapeusis. To this end I have been fortunate in enlisting the services of Mr. Albert Zimmerman, in charge of the laboratory of Mr. Horatio N. Fraser, who has entered with great enthusiasm upon the task, and spared no pains in details that have often been wearisome in the extreme. In this way there have been examined 31 cases of neurasthenia, 1 case of subacute mania, 2 of Raynaud's disease, 2 of hypochondria, 1 of *folie de doute* or mysophobia, 5 of melancholia, 4 of vertigo, 1 of lumbago, and, for reasons that will be seen farther on, 1 case of diabetes mellitus, 1 of spinal syphilis, and 3 of hemiplegia. In all of these cases tests have been made for albumin, sugar, urea, the phosphates, uric acid, calcium oxalate, casts, and indican; and in many of them the urine has been tested for nucleo-albumin from the bile, for serum-globin, fibrinogen, urobilin, and bile.

[1] Read before the New York Academy of Medicine, April 19, 1894.

Of the 31 cases of neurasthenia the following were the results:

In cases of one examination, heavy traces of albumin . . . 13
" " " " faint " " " . . . 14

In cases of more than one examination:

In one albumin was first faint, then heavy, then none.
In another " " heavy, " faint, " heavy.
" " " " faint, " faint.
" " " " heavy, " heavy.
" " " " heavy, " faint, " none.
" " " " faint, " faint.
" " " " faint, " faint
" " " " faint, " faint.

In one case there was no albumin.

Albumin from bile . . 6 Fibrinogen 2

Of these 31 cases of neurasthenia, the sugar was about:

0.10 per cent in . . . . 16 0.05 per cent, in . . . 8
0.15 " " . . . . 7 0.03 " " . . . 1

In the cases where there were heavy traces of albumin, the urea and the specific gravity contrasted as follows:

Urea.	Specific gravity.	Urea.	Specific gravity.
3.24	1.024	2.106	1.027
2.808	1.026	1.917	1.028
1.728	1.017	1.998	1.032
2.052	1.027	1.836	1.022
3.186	1.024	2.376	1.028
1.674	1.018	1.998	1.026
1.89	1.031		

In cases with faint traces of albumin, the urea and the specific gravity were as follows:

Urea.	Specific gravity.	Urea.	Specific gravity.
1.782	1.026	1.836	1.024
2.538	1.029	1.647	1.029
1.782	1.024	2.025	1.028
2.214	1.022	1.809	1.026
1.566	1.016	2.376	1.022
1.836	1.021	4.320	1.029
1.674	1.019	3.888	1.027
2.376	1.029	2 808	1.024
1.836	1 022	3.564	1.031
2.106	1.027	3.078	1.030
1.62	1.017	2.592	1.030
1.566	1.016		

In the 44 examinations of urine, in the 31 cases of neurasthenia, the uric acid, oxalate of calcium, phosphates, indican, and casts were:

Phosphates above normal . . . 33 Casts, present 20
Normal . . . . . 11 absent 24
Uric acid, above normal . . . 44 Indican, above normal . . . 43
Calcium oxalate, above normal . 44 normal 1

Of these 44 examinations, 21 were of one case only. In 3 cases, three specimens were examined. In 7 cases, two specimens were examined.

In five cases of melancholia, one examination each, there were:

Albumin, heavy traces	2	Urea and specific gravity contrasted:	
faint traces	3	faint tr. alb. 2.365	sp gr. 1.025
from bile	2	2.052	1.024
Sugar, 0.10 per cent.	2	Calcium oxalate, normal	1
0.05 "	3	above normal	4
Urea and specific gravity contrasted:		Uric acid, above normal	4
heavy tr. alb. 2.592	sp. gr. 1.024	normal	1
2.00	1.030	Casts, few hyaline	4
faint tr. alb. 0.702	1.012	absent	1
		Indican, above normal	5

In two cases of hypochondria, four specimens examined, there were:

Albumin, heavy traces	1	Phosphates, above normal	4
faint traces	2	Uric acid, above normal	4
none	1	Calcium oxalate, above normal	4
Sugar, 0.10 per cent.	2	Casts, few hyaline	3
0.05 "	1	none	1
0.075 "	1		
Urea and specific gravity contrasted:			
faint tr. alb. 2.10	sp. gr. 1.029	heavy tr. alb. 1.89	sp gr. 1.030
1.188	1.027	none, 1.975	1.029

In one case of *folie de doute*, four specimens examined, there were:

Albumin, faint traces	3	Phosphates, normal	1
none	1	above normal	3
Albumin, from bile	1	Uric acid, normal	1
Sugar, 0.10 per cent.	3	above normal	3
0.05 "	1	Calcium oxalate, normal	1
Urea and specific gravity contrasted:		above normal	3
faint tr. alb. 3.672	sp. gr. 1.026	Indican, above normal	4
3.78	1.027	Urobilin, slight	2
2.70	1.023	absent	2
no albumin, 3.726	1.025		

In two cases of Raynaud's disease, one specimen each, there were:

Albumin, heavy traces	1	Phosphates, normal	1
faint traces	1	above normal	1
fibrinogen	1	Uric acid, above normal	2
Sugar, 0.10 per cent.	1	Calcium oxalate, above normal	2
0.03 "	1	Urobilin, slight	1
Urea and specific gravity contrasted:		none	1
heavy tr. alb. 2.268	sp. gr. 1.022	Casts, few hyaline	1
faint tr. alb. 2.86	1.022	none	1

In three cases of insomnia, one specimen each examined, there were:

Albumin, heavy traces	1	Phosphates, normal	1
faint traces	2	above normal	2
from bile	1	Uric acid, above normal	3
fibrinogen	1	Calcium oxalate, above normal	3
Sugar, 0.05 per cent.	3	Casts, few hyaline	2
Urea and specific gravity contrasted:		absent	1
heavy tr. alb. 1.944	sp. gr. 1.024	Indican, above normal	3
faint tr. alb. 1.134	1.018	Urobilin, slight	1
1.458	1.010	absent	2

In one case of *petit mal*, one specimen examined, there were:

Serumglobin, faint traces . . . 1
Sugar, 0.10 per cent. 1
Urea and specific gravity contrasted:
urea, 0.702 sp. gr. 1.009

Phosphates, normal 1
Uric acid, above normal . . . 1
Calcium oxalate, above normal . 1
Indican, normal 1
Casts, absent. 1

In two cases of epilepsy, one specimen each examined, there were:

Albumin, heavy traces . . . 1
faint traces 1
serum-globin 1
Sugar, 0.02 per cent. 1
absent 1
Urea and specific gravity contrasted:
heavy tr. alb. 1.674 sp. gr. 1.017
faint tr. alb. 1.242 1.012

Phosphates, normal 2
Uric acid, above normal . . . 2
Calcium oxalate, above normal . . 2
Indican, above normal . . . 2
Casts, few hyaline 1
absent 1

In one case of post-epilepsy, one specimen examined, there were:

Albumin, faint traces . . . 1
Sugar, 0.05 per cent. 1
Urea and specific gravity contrasted:
Urea, 1.836 sp. gr. 1.019
Phosphates, normal 1

Uric acid, above normal . . . 1
Calcium oxalate, above normal . . 1
Indican, normal 1
Casts absent.

In four cases of vertigo, six examinations of urine; three in one, one each in three, there were:

Albumin, heavy traces . . . 3
faint traces 3
from bile 5
Sugar, 0.10 per cent. 5
0.05 " 1
Urea and specific gravity contrasted:
heavy tr. alb. 3.024 sp. gr. 1.029
3 294 1.028
1.944 1.025
faint tr. alb. 1.674 1.029
2.16 1.027
2.025 1.020

Phosphates, normal 2
above normal 4
Uric acid, above normal . . . 6
Calcium oxalate, above normal . 6
Casts, few hyaline 4
absent 2
Indican, normal 1
above normal 5
Urobilin, slight 4
absent 2

In one case of lumbago, four examinations of urine, there were:

Albumin, faint traces . . . 2
heavy traces 2
from bile, faint traces . . 2
Sugar, 10 per cent. 2
15 per cent. 2
Urea and specific gravity contrasted:
heavy tr. alb. 2.052 sp. gr. 1.025
2.16 1.026
faint tr. alb. 2.322 sp. gr. 1.028
3.078 1.030

Phosphates, normal 1
above normal 3
Uric acid, above normal . . . 4
Calcium oxalate, above normal . 4
Indican, above normal . . . 4
Urobilin, slight 4
Casts, few hyaline 4

In one case of neuritis, one specimen examined, there were:

Albumin, faint traces 1
Sugar, 0.01 per cent. 1
Urea and specific gravity contrasted:
urea, 1.296 sp. gr. 1.012
Phosphates, normal 1
Uric acid, normal 1
Calcium oxalate, normal . . . 1
Casts, absent. 1
Indican, normal 1

In one case of post-neuritis, one specimen examined, there were:

Albumin, heavy traces . . . 1
fibrinogen 1
Sugar, 0.02 per cent. 1
Urea and specific gravity contrasted:
urea, 1.728 sp. gr. 1.014
Phosphates, normal 1
Uric acid, normal 1
Calcium oxalate, normal . . . 1
Indican, normal 1
Casts, absent.

In one case of rheumatic neuritis, one specimen examined, there were:

Albumin, faint traces 1
Sugar, 0.05 per cent. 1
Urea and specific gravity contrasted:
urea, 1.296 sp. gr. 1.014
Calcium oxalate, above normal . . 1
Phosphates, normal 1
Uric acid, above normal . . . 1
Casts, absent.
Indican, above normal . . . 1

In one case of hysteria, one specimen examined, there were:

Albumin, faint traces 1
Sugar, 0.02 per cent. 1
Urea and specific gravity contrasted:
urea, 2.268 sp. gr. 1.022
Uric acid, above normal . . . 1
Calcium oxalate, above normal . . 1
Phosphates, above normal . . . 1
Indican, above normal . . . 1
Urobilin, slight 1
Casts, absent.

In one case of nymphomania, one specimen examined, there were:

Albumin, faint traces 1
Sugar, 0.10 per cent. 1
Urea and specific gravity contrasted:
urea, 2.025 sp. gr. 1.020
Phosphates, normal 1
Uric acid, above normal . . . 1
Calcium oxalate, above normal . . 1
Indican, above normal . . . 1
Casts, few hyaline 1

In one case of neuralgia, one specimen examined, there were:

Albumin, very faint traces . . . 1
Serum-globin, very faint traces . . 1
Sugar, 0.15 per cent. 1
Urea and specific gravity contrasted:
urea, 3.537 sp. gr. 1.025
Phosphates, above normal . . . 1
Uric acid, above normal . . . 1
Calcium oxalate, above normal . . 1
Indican, above normal . . . 1
Casts, few hyaline 1

In one case of torticollis, one specimen examined, there were:

Albumin, heavy traces . . . 1
Sugar, 0.05 per cent. 1
Urea and specific gravity contrasted:
urea, 1.728 sp. gr. 1.020
Phosphates, normal 1
Uric acid, above normal . . . 1
Calcium oxalate, above normal . . 1
Indican, abundant 1
Casts, few hyaline 1

In one case of tic douloureux, one specimen examined, there were:

Albumin, faint traces 1
Sugar, 0.02 per cent. 1
Urea and specific gravity contrasted:
urea, 1.566 sp. gr. 1.010
Phosphates, above normal . . . 1
Uric acid, above normal . . . 1
Calcium oxalate, above normal . . 1
Indican, above normal . . . 1
Urobilin, absent 1
Casts, absent 1

In one case of intra-cranial syphilis, one specimen examined, there were:

Albumin, heavy traces . . . 1
Sugar, 0.15 per cent. 1
Urea and specific gravity contrasted:
urea, 2.214 sp. gr. 1 020
Phosphates, above normal . . . 1
Uric acid, above normal . . . 1
Calcium oxalate, above normal . . 1
Indican, above normal . . . 1
Casts, absent.

In two cases of spinal syphilis, one specimen each examined, there were:

Albumin, heavy traces . . . 1
faint traces 1
from bile, heavy traces . . 1
Sugar, 0.05 per cent. 2
Urea and specific gravity contrasted:
faint tr. alb. 1.782 sp. gr. 1.029
heavy tr. alb. 1.404 1.028
Phosphates, above normal . . . 1
normal 1
Uric acid, above normal . . . 2
Calcium oxalate, above normal . . 2
Casts, abundant, hyaline . . . 1
absent 1
Indican, above normal . . . 2
Urobilin slight 2

In one case of nervous syphilis, two specimens examined, there were:

Albumin, heavy traces . . . 2
fibrinogen 1
Sugar, 0.10 per cent. 1
0.05 " 1
Urea and specific gravity contrasted:
urea, 2.376 sp. gr. 1.019
1.82 1.017
Phosphates, normal 2
Uric acid, above normal . . . 2
Calcium oxalate, above normal . . 2
Indican, above normal . . . 2
Urobilin, absent 2
Casts, few hyaline 2

In one case of alcoholic meningitis, six specimens examined, there were:

Albumin, abundant 1
faint traces 4
none 1
Sugar, 0.05 per cent. 2
0.03 " 4
Urea contrasted with specific gravity:
heavy tr. alb. 2.025 sp. gr. 1 025
faint tr. alb. 1.512 1.022
1.674 1 017
1.728 1.021
1.620 1.019
no albumin, 2.279 1.019
Phosphates, normal 3
above normal 3
Uric acid, above normal . . . 5
normal 1
Calcium oxalate, above normal . . 5
normal 1
Indican, above normal . . . 5
normal 1
Casts, abundant hyaline . . . 1
few hyaline 2
absent 3

In one case of general paresis, one specimen examined, there were:

Albumin, faint traces 1
Sugar, 0.03 per cent. 1
Urea and specific gravity contrasted:
urea, 1.458 sp. gr. 1.014
Phosphates, normal 1
Uric acid, above normal . . . 1
Calcium oxalate, above normal . . 1
Indican, abundant 1
Urobilin, absent.
Casts, few hyaline 1

In three cases of hemiplegia, one specimen each examined, there were:

Albumin, faint traces 3
from bile, heavy traces . . 1
Sugar, 0.10 per cent. 2
0.075 " 1
Urea and specific gravity contrasted:
urea, 1.296 sp. gr. 1.014
2.484 1.031
2.268 1.023
Phosphates, normal 1
Phosphates, above normal . . . 2
Uric acid, above normal . . . 3
Calcium oxalate, above normal . . 3
Casts, few hyaline 2
absent 1
Indican, above normal . . . 3
Urobilin, absent 2
slight 1

In one case of subacute mania, two specimens examined, there were:

Albumin, faint traces	2	Uric acid, above normal	2
from bile, heavy traces	1	Phosphates, above normal	2
Sugar, 0.15 per cent.	1	Calcium oxalates, above normal	2
0.10 "	1	Indican, abundant	2
Urea and specific gravity contrasted:		Urobilin, slight	2
urea, 2.754 sp. gr. 1.026		Casts, few hyaline	1
2.916 1.028		absent	1

In one case of diabetes mellitus, five specimens analyzed, there were:

Albumin, faint traces	4	Phosphates, above normal	5
none	1	Calcium oxalate, above normal	5
Sugar, 0.10 per cent.	2	Uric acid, above normal	5
0.05 "	3	Casts, none	5
Urea and specific gravity contrasted.		Indican, above normal	5
faint tr. alb. 1.94 sp. gr. 1.030			
2.268 1.031			
1.944 1.031			
2 16 1.032			
no albumin, 2.118 1.029			

In most of these cases, therefore, albumin, sugar, excess of phosphates, oxalate calcium, uric acid, and indican have been found.

How are we to interpret these findings in the light of our present knowledge of the genesis of these different constituents of the urine?

The almost constant presence of albumin in heavy or slight traces has been of the most interest to me. It is a well-recognized fact that this substance is often to be found in the urine of normal individuals under certain well-known conditions. This has been shown by Jackson[1] to occur after cold baths; in the newborn;[2] in children and young people;[3] in pregnant and nursing women;[4] after muscular exertion and perspiration, and after meals.[5] It is also well known that it occurs in many pathological conditions other than in nephritis, such as lipuria,[6] chyluria, hæmoglobinuria, and from compression of the thorax.[7] None of these causes have been present in my cases. I have, moreover, been especially careful in all these patients to look for the cardiac and arterial lesions characteristic of nephritis, and in many of them I have also tested the arterial pressure, and whenever I have found any of the former they have been excluded from these tables, whilst I have admitted some few instances of the latter who presented no other evidences of renal lesion. My tables may therefore be taken to consist of cases in which no nephritis was evident, except one choose to regard the albuminuria as such. I am very loath, however, to jump to this latter conclusion, because of the fact that the course of these cases is not that of any form of nephritis, as most of them are perfectly curable, as well as for the reason that the same amount of albuminuria is found in such other cases

[1] British Medical Journal, 1873.
[2] Virchow's Ges. Abhndlng., 1856.
[3] Dohrn Monat. f. Geburtsh., Bd. xxix.
[4] Martin and Ruge.
[5] Zeitschr. f. Geb. u. Frauenkrkh., 1876.
[6] Ribbert: Virchow's Arch., Bd. xcviii.
[7] Schreiber: Arch. f. exp. Pathol., 1885.

of functional nervous disease as I have catalogued. In other words: either neurasthenia, *folie de doute*, hypochondria, melancholia, vertigo, with slight albuminuria, are cases of nephritis, or else slight albuminuria is merely an attendant symptom of these cases of functional nervous disease. The former proposition seems to me ridiculous, inasmuch as there is not the slightest proof of it, whilst the latter belief is at least tenable, because all the proofs so far attainable are in favor of it. Moreover, these cases of albuminuria are almost always attended by varying amounts of urinary sugar, which is not necessarily a concomitant symptom of nephritis. On the other hand, I cannot remember ever having seen a case of albuminuria in functional nervous disease pass into well-marked nephritis. Of course, this statement must be taken with some reservation, because, as I have already said, I have only had the urine of these cases thoroughly examined within the last two years; but, then, I have treated many hundreds of such cases of neurasthenia, and I think it is probable that my memory would not have deceived me had any of them ever passed on into any form of renal lesion. So far as I have seen, I believe that the renal diseases begin to show the arterial or cardiac symptoms very soon after the albuminuria is manifested, or indeed occasionally even before, whilst œdema is a frequent symptom when the disease has lasted for some time. In these particulars, therefore, the albuminuria which I am describing would seem to be of a different type of disease. For the last thirty years Semmola, of Naples, has been claiming that the albumin found in the urine in Bright's disease is a different kind of albumin from that which is found in other lesions, as, for instance, those of the heart; nor, from *a priori* reasoning and the facts which I have adduced, does this seem at all improbable. Indeed, in one of my cases I found that the albumin was albumose, and, as I have already said, such other albumins as fibrinogen and albumin from bile have been frequently encountered. It would be very tempting indeed for me here to pass into a digression on the researches of Meissner, Brücke, Schützenberger, Kühne, Neumeister, Chittenden, and others as to the action of the gastric juice and its constituents on the proteids, and to discuss with you what we know about parapeptone, metapeptone, hemiprotein, hemialbumin, antialbumid, antialbumat, antialbumose, hemialbumose, antipeptone, and all the varieties of the albumoses; but, aside from the fact that this would constitute a paper in itself, these distinctions are of no pertinency to this investigation except to the chemical investigator himself. I have only been able to obtain two communications of Semmola,[1] presented to the Academy of Medicine of Paris respectively in 1883 and 1887. In these two papers are contained a series of experiments upon dogs, showing that forced

[1] Nouvelles contributions à la Pathologie et au Traitement de la Maladie de Bright. L. Di Mariano Semmola, Paris, 1883. Nouvelles Recherches expérimentales cliniques sur la Maladie de Bright, Paris, 1887.

alimentation with the white of egg produced first a congestion and then hemorrhage between and within the glomeruli, as well as between the glomerulus and Bowman's capsule; and, further on, a diapedesis of leucocytes upon the smaller tubes and between the uriniferous tubes, together with alteration of the epithelium of the tubes between the ascending loop of Henle and the straight tubes; whilst with still larger quantities of white of egg, molecular alterations extended throughout all the structures of the kidney. This is conclusive so far as it goes, but it only shows the effect of one form of albumin—that of the white of egg; but Stockvis has found that even this white of egg does not appear in the urine when it has been cooked before ingestion. Whether other kinds of albumin are capable of causing this implication of the kidney is a matter as yet unsolved, and these experiments therefore cannot be applied to the determination of the effect of the albumin which I have found in my cases, as this was certainly not an egg albumin. It is a significant fact in this connection that, until within the last ten years, none of the life insurance companies of Continental Europe have been in the habit of examining the urine of applicants; and yet their death-rates, so far as statistics are capable of showing, do not differ from those of the American companies, in which the urine is always carefully examined.

I have found Millard's test to be a much more reliable one than that by heat and nitric acid, inasmuch as I have frequently failed to find slight amounts of albumin by the latter when they have been found by the former; whilst, on the other hand, I have never failed to find albumin with heat and nitric acid when it had been demonstrated by Millard's test. It has frequently happened to me to have the urine of patients examined by excellent physicians without the finding of albumin, and yet I have been able to demonstrate it to myself conclusively; indeed, so often has this happened that I have grown to be very skeptical about the ordinary medical examination of urine. The explanation of this discrepancy to my mind lies in the fact that perfectly demonstrable slight or heavy traces of albumin can very readily be overlooked unless the test-tube is sparklingly clean and held in a proper light. I think, too, that we physicians have been so much accustomed to finding great flakes of albumin, or coagulated or heavy clouds, such as we see in advanced cases of nephritis, that we have grown to be careless in the determination of relatively smaller amounts. Nevertheless albumin is albumin, whether it fills the half of a test-tube or causes mere streaking that is only visible to the eye of a careful examiner. I have also asked myself whether, with such a delicate test as Millard's, albumin would not be found in every urine, and the more especially as Posner,[1] examining the urine of seventy healthy persons, found albumin

[1] Berlin. klin. Wochenschr., 1885, S. 1881.

almost constantly, although doubt, it should be borne in mind, has been cast upon these observations by Malfatti,[1] who shows that what was mistaken for serum-albumin was really mucin, coming from the mucous glands of the urinary passages. In about 20 per cent. of the cases, however, of various kinds which I have carefully examined with Millard's test, no albumin whatever has been found, whilst I can count up over a thousand cases that have been examined by other physicians by Millard's test, in which albumin was not found either, although, for reasons which I have detailed already, I should not insist upon the absolute accuracy of these latter examinations. In 1017 cases in which the urine was examined in applicants for life insurance, the results were as follows:

No albumin	863
Albumin found by heat test	24
" " " Heller's No. 3	27
" " " Tanret's test	43
" " " Millard's test	45
" " " picric acid	5
Total number in which albumin was found	144

The sugar which I have found in these urines has been determined by either Fehling's or the indigo carmine test. I have found the latter far the most delicate and reliable, and I now use it in all cases. That there is some close relationship between glycosuria and these cases attended with albumin and nephritis on the one hand, and true diabetes on the other, has seemed probable to me, from the following facts. First, a young man coming to me from a far Southern State had all the facial appearances of a case of diabetes mellitus, as well as the great thirst and the marked odor of the breath. Four examinations of the urine, at different times, showed heavy traces of sugar. I ordered him to go to a Western climate, whence he returned to me after a year's interval, and then I found that the thirst and the odor of the breath had disappeared entirely, whilst the sugar and albumin had vanished from the urine. Second, several of these individuals have presented the blanched *facies* characteristic of renal disease just before the time when œdema of the lids is prone to appear.

These cases which I am describing are probably the cases which have postured for many years in medical literature as those of lithæmia. In other words, I believe that most, if not all, cases in which there is an excess of uric acid in the urine will be shown to present traces of albumin and sugar, provided the patient has shown symptoms of ill-health. I am not prepared to say, however, that excess of uric acid alone will cause ill-health, or that there may not be cases of excess of uric acid in the urine without albumin and sugar. The whole question

[1] Internat. Centralbl. f. Phys. u. Path. d. Harnorg., 1889.

of the formation and the import of uric acid seems to me to be as far from solution as ever. The two great theories to-day are those of Haig and Sir William Roberts, and they are diametrically opposed. Haig,[1] who has written so charming a book on the rôle of uric acid in disease that one is really disappointed in finding any logical objection to his conclusions, maintains that he has estimated for six years the uric acid which he himself excreted, and that the relation of uric acid to urea is about 1 to 30.5, varying to 1 to 0.35 or even 1 to 0.38, the mean being about 1 to 0.33. He also quotes Yvon[2] and Berlioz as finding that the relation was about 1 to 0.30 or 1 to 0.40, whilst Lecanu (this is quoted from Sir Dyce Duckworth, *A Treatise on Gout*, p. 20) found the relation to be 1 to 0.33. This uric acid, however, is excreted in varying quantities from day to day and hour to hour, and Haig explains this by the alternation of acidity and alkalinity of the urine, accompanied, he claims, by similar acid and alkaline conditions of the blood. Thus, when the urine and blood are alkaline the uric acid is held in solution and dissolved out of the various tissues of the body, whilst acidity of the urine and blood drive the uric acid back into the different tissues. As Garrod has shown that there is a so-called acid and alkaline tide of the urine, the alkalinity being greater during the day and the early morning, and the acid at its highest during the afternoon and at night, Haig attempts to show that the early day and the morning are the times when the uric acid is held in solution in the blood and urine, and, passing through the system, causes all the ill symptoms incident to such a condition, whilst comparative ease and comfort are obtained in the afternoon and evening as the blood becomes more acid and the uric acid no longer circulates throughout the system. Upon these explanations Haig bases a number of clinical and pathological conclusions. Thus, if the excretion of uric acid falls below what he considers the average amount, the surplus must be hidden away somewhere in the tissues, and this surplus can be brought again into the blood and thence into the urine by drugs or by certain febrile, dietetic, or medicinal means. Haig himself has been a lifelong sufferer from migraine, and he believes that he has obtained very great relief by putting himself upon a diet consisting of milk, eggs, fish, fowl, game, vegetables, fruits, and tea, coffee, or cocoa in moderation. He claims, moreover, that the medicinal substances increasing the excretion of uric acid are alkalies, salicylic acid and its compounds, salicin, salol, and other compounds of this class, such as phosphate of soda, piperazidin, and quinine, whilst the chief substances diminishing the excretion of uric acid are acids, iron, lead, lithia, manganese, calcium chloride, acid phosphate of soda, some sulphates, chlorides, etc., and many substances which directly or indirectly cause the acidity or

[1] A. Haig: Uric Acid as a Factor in the Causation of Disease. 1892

[2] Revue de Médecine, September, 1884.

otherwise form insoluble compounds with uric acid, as opium, cocaine, mercury, antipyrine, caffeine, the nitrites, some hyposulphites, and strychnine. The most valuable of the excretants he considers to be the alkalies, salicylic acid and its compound form, salicyluric acid. He points out that phosphate of soda, although a valuable excretant, can only act in an alkaline medium, or while the supply of alkalies is abundant, as the presence of any acid or even of a salt of a mineral acid, as a sulphate, appears to convert it into the acid phosphate when there is no longer a plus excretion of uric acid—so that the phosphate of soda should be given with alkalies. Salicylates, on the other hand, act best when the alkalinity is low, and their action as regards the excretion of uric acid appears to be absolutely hindered by the presence of alkali, so that they do best in conditions of fever, when the alkalinity is generally low, and in conditions where there is little or no fever it may be necessary to give them with opium or ammonia, which raise the acidity, or in alternate doses with acids to obtain their full effect on the excretion of uric acid. Piperazidin appears to have little effect upon the excretion of uric acid, and is also impaired in its effect by acids. Upon this basis of commingled facts and theories Haig blazes a path into many obscure phenomena of disease, very much to his own satisfaction. Unfortunately, however, many of his arguments are pure theory, and of his clinical data, although I have tried to verify several of them, there is only one which has been confirmed by my own experience, namely, that a strict observance of his theory about the action of drugs will do more to modify the suffering of migraine than any therapeutic procedure which I have tried in a medical life of twenty-one years. I have found that case after case of migraine will be benefited by the administration of twenty drops of nitro-muriatic acid before meals, and three to five grains of the salicylate of soda after meals; and modified, too, in such a way that the attacks of migraine have in several instances disappeared for months, and even then, returning, are very much less severe than formerly. His restriction of the diet I have frequently tried in former years without the slightest effect, although my experiments at that time were open to the objection that I was not acquainted with his medicinal hints; but I have not been willing to try it again with my patients, because restriction of nitrogenous diet is, in my experience, a very dangerous thing for the man or woman who has this world's work to do, inasmuch as it diminishes their well-being seriously, and thus limits their output of energy. Haig himself admits that there is some force in this objection, because he especially cautions against a sudden reduction of nitrogenous food. I might have been willing to try again the more gradual and systematic reduction of nitrogenous material as food, had not the examinations which I am describing to-night of the urines of different patients, caused me to think that in all

these cases of mine, and possibly even in Haig's, we had to deal with an increased excretion not only of uric acid, representing one of the terminal forms of nitrogenous diet, but also with albumin and sugar, representing respectively another nitrogenous excretion as well as one of the hydrocarbons. Moreover, in the "Croonian Lectures" for 1892, Sir William Roberts has a theory of uric acid which is diametrically opposed to Haig's, and the one is quite as well supported as the other by seeming facts. Let me ask your attention for a few minutes to Sir William Roberts' almost revolutionary propositions. As is well known, uric acid is regarded by chemists as bi-basic, *i. e.*, as an acid containing two atoms of replaceable hydrogen represented by the formula $H_2(C_5H_2N_4O_3)$, or more simply as H_2u. It forms, like every bi-basic acid, two regular areas of cells, namely, neutral urates with the M_2u, and acid urates or bi-urates with the general form MHu. The neutral urates cannot exist in the living organism, as they can only be produced in the presence of caustic alkalies and in the absence of carbonic acid and the carbonates, and Sir William Roberts therefore dismisses them from consideration. The bi-urates, on the other hand, are sparingly soluble in water, but are not decomposed thereby; and when such solutions are evaporated, the bi-urates are again deposited unchanged. They are never seen as a deposit in the unchanged urine either in health or disease; but when the urine undergoes ammoniacal decomposion the ammonium urate may occasionally be detected in the sediment as minute elongated dumb-bells, mixed with the amorphous phosphate of lime and the ammonia-magnesian phosphate, which constitutes the ordinary sediment of decomposed urines. Although these bi-urates are salts of uric acid, Sir William Roberts contends that there is no proof that uric acid ever exists as a true bi-urate in solution in the normal urine, and he introduces evidence to show that when these bi-urates are artificially introduced into the normal urine they fail to maintain their integrity, and at once undergo a change of composition; nor does he deem that there is any actual proof that uric acid ever exists as a true bi-urate in the healthy blood and interstitial juices. Nevertheless, it is susceptible of proof, in his opinion, that in certain abnormal circumstances bi-urates can and do arise under conditions which habitually prevail in the living body; thus, artificial solution of uric acid in healthy blood-serum will ultimately give rise to the production of crystals of sodium bi-urate. The word "ultimately" should here be emphasized, because uric acid does not at first enter into solution in blood-serum as true bi-urate, but this state of combination is slowly developed and gradually obtained after a certain lapse of time. He admits, however, that uric acid in some form of combination or other does exist normally in minute quantities in healthy blood, and he attempts to solve the question as to what this form of combination is. First, he demonstrates the identity of the

amorphous, solid, or semi-solid urinary deposit with the urinary secretion of birds and serpents. He calls attention to the researches, away back in 1862, of Dr. Bence Jones, who had shown that the action of water on the amorphous urate deposit and kindred compounds is to split them up into free uric acid and the bi-urates contained in them; but if this theory were correct, the quantity of uric acid thrown out by water should, of course, exactly equal the quantity retained in the solution as bi-urate. This was precisely what Bence Jones failed to demonstrate. Continuing the investigation onward from this point, Sir William Roberts has apparently proved that there exists a third order of uric acid salts differing essentially from the two urates already known, and having a composition corresponding to the hypothetical formula of a quadri-urate, the form of which would be $H_2(C_5H_2N_4O_3)MH(C_5H_2N_4O_3)$, or, he says more simply, H_2u, MHu. These quadri-urates present themselves usually as amorphous powders, but the spheres of birds' and serpents' urine are distinctly crystalline and display a black cross. These forms are permanent if kept perfectly dry; they readily assume a gelatinous modification, and when examined under the microscope in this state appear as large, translucent globules. They are extremely unstable, and they tend to change in two opposite directions. In weak solutions of the alkaline carbonates or the bi-metallic phosphates they slowly take up an additional atom of the base and are converted into bi-urates. On the other hand, in water and in watery solutions of the neutral salts they are split up into free uric acid and bi-urates. These two actions cover the behavior of the quadri-urates in the blood and the urine respectively, and furnish a key to the chemical processes which culminate in the formation of gouty deposits and calculous concretions. The only proper solvent for the quadri-urates is the healthy urine. In acid urines they dissolve freely with the aid of heat, and are again precipitated unchanged on cooling. Such solutions are, however, not stable; after a time their uric acid is slowly and at length completely liberated. The quadri-urates are still more freely soluble in hot alkaline urines, and in these media they continue perfectly unaltered and guarded against septic changes. When such solutions are made at boiling heat, they throw down on cooling bulky deposits which are identical with the natural amorphous urate sediment. From these experiments, therefore, Sir William Roberts draws the conclusions: first, that free uric acid is not known physiologically either in the body or the urine, but clinically and pathologically as crystalline sediments in the urine and as gravel and calculus in the urinary passages; second, that the neutral urates are not known physiologically or pathologically, but only as laboratory products; third, that the bi-urates are known pathologically as components of gouty concretions in the tissues, and only in the urine after the secretion has undergone ammoniacal fermentation, whilst it is

doubtful if they ever exist physiologically in the blood or tissues; that the quadri-urates are especially the physiological combinations of uric acid, existing normally in the urine and probably also in the blood—the latter constitute the entirety of the urinary secretion of birds and serpents—and all the morbid phenomena due to uric acid arise probably from secondary changes in the quadri-urates. He adds to this that "These considerations point to the idea that the residuum of uric acid in mammalian urine may be something in the nature of a vestigial feature—something analogous with the vermiform appendix, the ductus arteriosus, or the ear-point. These residuary structures are now regarded by biologists as indications of the line of ontological descent. On this view the presence of uric acid in the mammal's urine should be regarded as a memory of some ancestral form which eliminated its nitrogens as uric acid. The extreme inconstancy of uric acid, both in regard to its presence and proportion in the urine of different species, and in different individuals of the same species, agrees perfectly with this theory, for vestigial structures are remarkable for their inconstancies." This author is inclined to regard the fact that uric acid (gravel) is constantly seen as an independent disorder without disease of the stomach or liver, or general constitutional vice, in persons who are in all other respects perfectly healthy, as a vestigial or atavistic relic. Sir William Roberts also considers the effect of the precipitation of uric acid in the urine, of the degree of urinary pigmentation, the proportion of salines, the percentage of uric acid, and, above all, the grade of the acidity of the urine; but I have not space enough at my command to do more than to say briefly that he considers the deficiency of pigment as undoubtedly a factor, but is not able to offer any therapeutic suggestions to meet it; that as to the saline matters, he advises that the patient's food contain an adequate proportion of articles rich in such substances, *i. e.*, meat, fish, eggs, and salads; that he regards excessive acidity of the urine as an important factor in the precipitation of uric acid, most likely to occur during the time of sleep, and advises for this purpose the administration of the citrate or bitartrate of potash and soda, the former being the best preparation, to be administered at bedtime, 40 to 60 grains dissolved in three or four ounces of water. He moreover believes that, as each meal acts on the urine as a dose of alkali, frequent meals are desirable. He deprecates the use of mineral waters of any kind as being no more efficient than equivalent quantities of distilled water would be.

Thus, as you see, we are met by two widely differing theories. Haig supposes that uric acid is formed day by day in the blood and thence passes into the urine, whilst Roberts maintains that the uric acid is held in solution almost entirely as a quadri-urate and is only precipitated as uric acid in the kidneys, the ureters, or the bladder, at the same time that the constant amount of uric acid in the blood is very small and is

only a vestigial remnant. The former assigns to uric acid a large primary rôle, whilst the latter regards it as a factor which only becomes important in certain conditions inducing changes localized in the peripheral parts of the urinary apparatus. When these differences of opinion between two competent observers are taken into consideration, together with the albuminuria, glycosuria, and indicanuria which I am describing in my cases, the inference is unavoidable that large amounts of urinary uric acid are by themselves of slight importance, probably constituting only one of a group of urinary phenomena.

The indican which has been found in these cases has not been constant. Even whilst it has generally been present in cases of digestive disturbance, this has not always been the case. In examining these patients and in looking over the histories, I have always had in mind the series of brilliant and original articles by Herter, and I have endeavored in every way to trace the relationship between the indicanuria and intestinal disturbances. But I have finally come to the conclusion that the indican, like the uric acid, is only part of a general disturbance of metabolism, and that the decomposition, as represented by indican, of the proteids under the influence of bacterial action cannot be studied alone.

Urobilin is also a substance which has not been constant. At first I thought that it would bear some relation to anæmia, but this has not been evidenced in my cases, for neither the facial aspect, nor examination of the heart for anæmic murmurs, nor testing the blood by the hæmoglobinometer has demonstrated any lack of corpuscles in some cases where the urobilin was present, although urobilin was found in several in which anæmia was demonstrable. Several cases in which urobilin existed were slightly jaundiced, and the urobilin, therefore, may have been a transformation in the urine of normal bile-coloring matter.

The hyaline casts that have been occasionally found have been a source of considerable solicitude to me, because I am well aware of how often other substances are mistaken for them. Repeated examinations, however, verified in every possible way, have shown me that the observations in this respect are accurate.

From these cases and these examinations, therefore, it would appear that most cases of neurasthenia and many cases of functional nervous disease will show, with precise examinations, slight amounts of albumin, sugar, excess of uric acid, occasionally hyaline casts, whilst the excretion of urea is about normal. In other words, these cases excrete abnormal amounts of the terminal products of nitrogenized and hydrocarbonaceous metabolism. What becomes of the fats I do not know, unless, as is probable, they pass off through the lungs in the form of carbonic acid. It is probable that these delicate tests show greater amounts of sugar, albumin, uric acid, and hyaline casts in certain conditions than are found in states of health, although I have had many analyses made

in which none of them have been found. For these reasons I have believed that the following conclusions are justifiable:

1. Many functional nervous diseases, especially neurasthenia, can constantly or well-nigh constantly be accompanied by albuminuria, glycosuria, excess of uric acid and oxalate of lime, and occasionally by excess of urea, indican, and hyaline casts.

2. It is probable that these urinary products are results rather than causes of disease.

3. These conditions very probably represent what has been called lithæmia.

4. It is probable that many, if not most, of these cases are not cases of early nephritis.

5. It is possible that there are different albumins in the urine, and that upon the determination of these will rest the future diagnosis of nephritis from other diseases.

The treatment of these cases is not as yet, in my opinion, a satisfactory one. By this I do not mean to say that most of them cannot be cured, but that our present method of treatment must be prolonged, precise, and of a kind that interferes seriously with the patient's ordinary occupation. Evidently the increased metabolism that is indicated by these urinary findings must be either the result of nervous derangement, localized derangement of some one organ or set of organs, or some error in the chemical nature of the food-supply. The latter theory has been, and is to-day, the popular one in the medical profession. But it has only a very slight basis of fact, as a careful perusal of physiological treatises will show. It is true that we have an idea of the main actions of the digestive fluids, but we are far from having an accurate knowledge of all the chemical transformations taking place in the stomach and duodenum, influenced by the presence of the living tissues surrounding them. It sounds very commonplace to say that the reaction of an isolated digestive fluid in a test-tube is something very different from the capabilities of that same digestive fluid in its proper place and modified by its fellows and all the wondrous mechanism of Nature. If one will read through such careful text-books of physiology as the latest editions of Foster and Arthur Gamgee, this truism will become more apparent. Yet to day millions of capital are invested in manufacturing firms upon the blind faith that physicians seem to have in the accuracy of their knowledge of digestion and assimilation. In the cases which I have been describing I have not found any advantage from any one system of diet. I have tried the exclusion of nitrogenous material, then the avoidance of the hydrocarbons, then total abstinence from sugar, all without any avail, except that in certain cases a temporary reduction of the proteids has been of very perceptible advantage for the time being. In all the cases, however, in which there was a melancholia or

hypochondria, or epilepsy, or vertigo, or neuralgia, I have not found that diet had the slightest influence upon the nervous symptoms. I do not, therefore, believe that the urinary products are due alone to error in the food-supply. On the other hand, I have again and again seen cases of neurasthenia and melancholia recover after proper treatment of the nervous symptoms, and then the albuminuria and glycosuria would gradually disappear. I think that I am therefore warranted in concluding that the nervous disease is the cause of the altered metabolism in these cases. For therapeutic purposes I think that all these cases can be divided into three classes: First, cases without mental or nervous symptoms or intestinal disturbances; second, cases with intestinal disturbances, with or without mental or nervous symptoms; third, cases with marked mental or nervous symptoms.

1. The light cases without mental or nervous symptoms or intestinal disturbances are best treated by nitro-muriatic acid, twenty drops in a wineglass of water three times a day after meals; or in some instances Haig's prescription, of nitro-muriatic acid before and from two to five grains of salicylate of soda after meals, will answer best. I do not think that larger doses of the salicylate of soda are beneficial; indeed, I seldom go beyond two grains, for more than this is apt to depress the patient. Laxatives should be used gently and carefully in all these cases. Usually I have found Rochelle salt to be sufficient—a drachm in a tumbler of water before breakfast; but it is a great mistake to use the larger doses up to a half-ounce that are often advocated. Sometimes it will be well to use a few small doses of calomel before commencing with the Rochelle salt, say two grains at bedtime for one or two nights, or one-tenth grain given every hour for five hours, and followed next morning by the laxative. Where the constipation is very obstinate I have found that one-tenth grain of aloïn once, twice, or three times daily will be quite effective, and if it acts too precipitately it can be combined with advantage with two grains of the extract of cascara sagrada.

2. The cases in which there is intestinal disturbance may be subdivided into two classes: those in which there is intestinal disturbance alone, and those in which this is accompanied by mental or nervous symptoms. In both, the intestinal disturbance should be mitigated, if it be possible to do so, but in the cases with mental or nervous symptoms, the relief of the intestinal symptoms will not be sufficient, and can very often not be accomplished until the mental or nervous symptoms have been relieved. For the intestinal disturbance I have long given up the use of pepsin, as I believe that it only relieves temporarily, and its continued use will often aggravate. Sometimes pancreatin, in a combination that I shall speak of shortly, will act for a short time very beneficially. My patients have derived much more benefit from the subgallate of bismuth, salol, calomel, subnitrate of bismuth, codeia, lauda-

num, and salines. Of all these I believe that the subgallate of bismuth and salol are the most effective, in doses respectively of 5 and 2 grains three times a day. It is usually advantageous, however, to preface their use with a few doses of calomel in the manner that I have already described. In certain instances of great discomfort after meals, 5 or 10 grains of the subnitrate of bismuth will act like a charm, but it is not a reliable remedy. Where there is continued pain in digestion that cannot be relieved by these measures, moderate doses of codeia, $\frac{1}{4}$ to $\frac{1}{3}$ of a grain, three times a day, will be found to be very beneficial, or if this does not answer, 5 or 10 drops of laudanum may be substituted. These opiates, however, should never be continued very long, in my experience. In all cases, however, care should be taken to have one or two easy movements of the bowels daily, and this can be best attained by the methods already described. Naphthol, beta-naphthol, and guaiacol have not done well in my hands; I have not found them to compare in efficacy with the drugs I have just mentioned.

3. The cases in which there are nervous or mental symptoms with or without prostration, must be treated from an entirely different standpoint. The laxatives and digestives alone will often greatly aggravate the disease, and in this class of cases calomel is an especially dangerous remedy, for I have a number of times seen its use in melancholia followed by a violent outbreak. Rest, or more properly speaking, restriction of the expenditure of energy, is a *sine qua non* in the treatment of these severer cases. The principle of the rest treatment as advocated by Dr. Weir Mitchell is invaluable in these individuals, but the application that he makes of it I do not consider to be always judicious. Absolute and prolonged rest in bed is not necessary in cases of neurasthenia. I have seen many neurasthenics put on their feet after eight to twelve weeks of rigid rest treatment so ruddy and fat that it was a matter of painful surprise to find them incapable of more than slight exertion for weeks or months. This has led me to seek for modifications of Dr. Mitchell's plan. I have reluctantly abandoned massage; in the first place, because I believe that in many cases of neurasthenia it actually prolongs the weakened condition, whilst I have seen it aggravate cases of melancholia. Even in the severest cases I have found it quite sufficient to put the patients to bed for a few days or a week, then have them up and about in the afternoon, then simply stay in bed until ten in the morning and go to bed by eight or nine at night; whilst in the lighter cases the interdiction of walking, lying down for a few hours on a lounge each day, and getting long hours of sleep, may be all that is necessary. By these methods patients never lose the use of their muscles. They simply become somewhat more incapable of exercise, and that is easily rectified when the time comes. In cases of melancholia it is almost impossible to keep the patient in bed, as the morbid introspection renders

the quietude well-nigh unbearable, although, when rest can be obtained, it is always beneficial. Next to the enforced rest, I have found that the ingestion of large, what would often seem to be surplus, quantities of food is most important. This must, however, be done systematically, and day by day the food should be prescribed in increasing amounts until, at the end of ten days or two weeks, three full meals a day and a quart of milk should be taken in the twenty-four hours. In some cases of melancholia the aversion to food is so great that proper alimentation becomes a serious difficulty. When this is the case, I have always found that a threat of feeding by the stomach-tube was all that was needed, inasmuch as patients dread this and will compromise on any terms rather than have it. I have often, however, been forced to actually proceed as if I were about to carry out my threat, but in no single instance have I really had to do it, as the sight of the tube has been sufficient. Rest and surplus alimentation are usually of basic importance in these cases, but they will not do everything. In melancholia the careful and systematic use of opium and hypnotics is unavoidable; and in neurasthenics, iron, malt, and cardiac stimulants (the best of which is strychnine) are necessary. Properly (that is, systematically and vigorously) treated, these cases are of excellent prognosis. Left to run their own course, however, they are exceedingly chronic and apt to leave a condition of invalidism behind them.

In order to avoid interruption of the text, I have thought best to add the chemical methods which have been employed for the different substances as an appendix.

Millard's and Tanret's Tests as Albumin Reagents.

Tanret's.

Potass. iodide	3.32	grammes.
Mercury bichloride	1.35	"
Acetic acid	20	c.c.
Distilled water q. s.	100	"

Millard's.

Carbolic acid	f ʒij.
Glac. acetic acid	ʒvij.
Solut. potassa	ʒxxij.

Albumin. (*Serum albumin, serum or para-globulin, nucleo-albumin from bile, mucin from bile, mucin from mucous membrane.*)

Clarifying.—To about one ounce of the urine add about 60 grains of powdered French chalk, shake together, pour upon a four-ply wetted paper filter; throw away the first portion of the filtrate; return the following portions until the urine passes perfectly clear. When the specimen is in an advanced state of mucus formentation, in which the mucus is so minutely subdivided by the increased number of bacteria that it cannot be clarified by the above method, then the addition of caustic potassa or soda to strong alkaline reac-

tion without heat, followed by filtration through a wetted double paper filter, will clarify it. It will be necessary to return the filtrate several times before it passes perfectly clear.

The filtered specimen is divided into three-quarter-inch test-tubes, filling them about one-third full. To the first add 15 drops of Tanret's test; to the second 15 drops of Millard's test; to the third 15 drops of acetic acid. The reaction should be acid in all the tubes. Heat the three tubes to the boiling-point, and while the contents are hot hold them up to a good light, with a strip of black paper or card-board a short distance back of them, about half the way up to the level of the fluids, and note the results. Set aside for thirty minutes, and again heat to the boiling-point and note the results a second time. It is important that this length of time elapse before noting the last result, as minute quantities of albumin require this length of time for complete precipitation. The results should be noted directly after heating to the boiling-point, as one of the reagents precipitates all the alkaloids, peptones, and ptomaïnes, the other only a few of them, the precipitates of these bodies being retained in solution while hot; consequently they do not interfere with the albumin reaction.

The tube to which the acetic acid has been added is best held between the tubes containing the other reagents, any change in reaction being more easily perceptible. The acetic acid is used in addition to the reagents to detect soluble and dissolved mucin, combined acids of oleoresins, combined fatty acids, and other bodies yielding precipitates in acid media. The albumin reagents all being used in acid media, form precipitates when such substances are present; thus the acetic acid prevents any errors which may otherwise arise.

If albumin be present there will be an increased cloudiness or precipitate in the tubes to which the Millard's and Tanret's tests have been added. When very faint traces are present the opalescence produced, being distributed throughout the liquid, is more easily perceptible than the results obtained by applying the zone or contact test; the reagents being free from color, and the urine also deprived of considerable coloring matter by filtration through the French chalk, gives greater delicacy to the reaction.

When the specimen is acid and the reaction by Millard's test is more decided than that by Tanret's and acetic acid, being least by Tanret's, it shows the presence of mucin from bile and the nucleo-albumin from bile. This mucin appears to be the only soluble form of mucin found in acid urine, and with it is always to be found the nucleo-albumin, the mucin from the mucous membrane being soluble only in alkaline urine. The reason the Millard's test gives this increased reaction is that it is a more delicate reagent for mucin than either acetic acid or Tanret's test.

When the reaction is more decided in the tube containing the acetic acid than it is in the tubes to which the Tanret's and Millard's tests have been added, and no foreign bodies are precipitable by acetic acid, it shows the presence of serum or para-globulin.

When serum albumin alone is present, the reaction is indicated in the tubes containing the Millard's and Tanret's tests, acetic acid giving no reaction unless mucin be present, as in alkaline urine or in specimens which have been treated with alkali for clarification, when the source is the mucous membrane, or in acid specimens when it is derived from the bile. When mucin is present in solution from either source the Millard's test always gives a more increased reaction than the Tanret's test or acetic acid, being much more decided in the tubes containing the acetic acid and the Millard's test.

When any of the other forms of albumin are present with the serum albumin, the specimen is best treated with one-fourth its volume of glacial acetic acid, heated to boiling, set aside for one hour, then filtered through French chalk as above directed. This separates mucin from bile and mucous membrane, serum-globulin, and foreign substances, there being retained in solution serum-albumin and the nucleo albumin from bile, and these may readily be differentiated by adding ferrocyanide of potassa to the acetic acid solution, with-

out applying heat; the ferrocyanide being a more delicate reagent for the nucleo-albumin than either Tanret's or Millard's tests, yields a heavier reaction.

Sugar.

Water, 1 drachm; copper solution, 10 drops; alkaline tartrate, 10 drops; heat to boiling, continue heat for one minute; if no change has taken place it shows the solution to be reliable. Add now 10 drops of the urine, heat again to boiling, continue the heating for one minute; set aside for ten minutes; if no reaction by separating suboxide of copper, it shows the sugar to be present below 0.10 per cent.

To show the presence of less than 0.10 per cent. sugar in urine, it is necessary to use the indigo-carmine test, consisting of two separate solutions; a 0.2 per cent. solution of sodium-indigo sulphate in acidulated distilled water in the one, and the other a 25 per cent. aqueous solution of crystallized sodium carbonate, used by adding 5 drops of the sodium-indigo sulphate solution to a drachm of the sodium carbonate solution, heat to boiling, when the solution will acquire a green color. Add now 10 drops of the urine, heat again to boiling, and keep the fluid as near this temperature as possible without ebullition for one minute, by holding the tube in the flame withdrawing and successively replacing it at short intervals. If sugar is present, the color will pass from green to violet, purple, red, and finally straw-color, which remains without further change in color, the latter color being the indication for the presence of sugar. By shaking the tube to admit oxygen of the air and cool the fluid, the colors will return in the inverse order to that which they appeared. By this method urine containing 0.01 per cent. sugar will change the test to a red, while 0.02 per cent. changes it slowly to the straw-color; the greater the proportion of sugar the more rapid will be the change to yellow, and from the degree of rapidity with which this change in color takes place, the proportion of sugar may be approximately estimated.

Uric Acid.

Taking 0.01 per cent. as normal standard.

To a definite portion of the filtrate from the phosphate test, add a concentrated solution of nitrate of silver until the mixture becomes deep gray or black, set aside for fifteen minutes; add half a volume of stronger water of ammonia, set aside, allow precipitate to subside, and pour off as much of the clear liquid as possible; again add an equal volume of stronger water of ammonia to the residue mixture; set aside for half an hour and note bulk of the precipitate and compare it with a standard volume or bulk obtained as an average from several specimens containing the above amount.

The uric acid is precipitated as silver urate.

If urates or free uric acid have separated as a precipitate, they are re-dissolved by adding a slight excess of solution of caustic soda to the specimen previously well shaken, diluting with half a volume of water, making neutral with dilute nitric acid; then proceed to precipitate the phosphoric acid as directed under phosphates. Keep the volume of the fluid double that of the urine.

Meat diet very acid by acid phosphates crystallizes uric acid and retains the oxalate of calcium in solution.

Carbohydrate diet, faint acid by acid phosphates, sometimes alkaline by alkaline phosphates, crystallizes oxalate calcium and retains uric acid in solution.

The acidity of the urine is reduced by the acid fermentation (lactic and butyric) of the carbohydrates, forming lactates and butyrates, which, like citrates and acetates when administered, reduce the acidity of the urine. And these acds (lactic and butyric), like some of the constituents of meat under impaired oxidation, instead of being oxidized to carbonic acid as they are normally, yield intermediate products of oxidation, as oxalic acid for example.

With few exceptions, as the proportion of uric acid increases, the indican reaction becomes more intense.

Indican.

Jaffe's Test.

To concentrated hydrochloric acid (ʒj) add a minute quantity of chlorinated lime; then add one-quarter of a volume of the urine; if the chlorinated lime is added to excess the color will be destroyed, if not in sufficient quantity the reaction will be faint. With few exceptions, the indican is increased as the uric acid rises in proportion.

Urobilin.

100 c.c. of urine, shaken with 50 c.c. ether, the ether separated, evaporated without heat, the residue dissolved in alcohol and examined by micro-spectroscope.

Oxalate Calcium.

Taking 0.005 per cent. as a normal standard.

100 to 200 c.c. of the urine previously well shaken, add from 5 to 10 c.c. of a 25 per cent. solution of calcium chloride, add ammonia to alkaline reaction, shake well, neutralize by acetic acid, set aside for twenty-four hours; separate precipitate by filtration, wash with water, wash with hot solution of soda, then again with water, until the filtrate shows no perceptible reduction with permanganate of potassium; allow to drain, dissolve the residue in dilute sulphuric acid, washing the filter carefully with the dilute acid, heat the filtrate to near boiling-point, and titrate with $\frac{1}{10}$ permanganate; each c.c. = 0.0054 calcium oxalate.

Bile.

Huppert's Method.

To 2 ounces of urine add about 2 drachms of milk of lime—shake well—separate precipitate by filtration, transfer to test-tube, add alcohol and concentrated sulphuric acid; upon heating, the alcohol acquires a green-yellow color.

Phosphates.

Taking 0.20 per cent. as a normal standard.

Dilute the urine with an equal volume of water; to one-half ounce of the mixture add two drops of a 25 per cent. solution of magnesium sulphate, then four drops of stronger water of ammonia; shake well, then set aside for half an hour, note bulk of the precipitate, and compare it with a standard volume or bulk obtained as an average from several specimens containing the above proportion.

The phosphoric acid is precipitated as ammonio-magnesium phosphate.

If a portion of the phosphates have separated from solution in alkaline specimens, they should be re-dissolved nitric acid, then made neutral by caustic soda, before proceeding as above.

Urea.

Estimated by the hypobromite method in a nitrometer.

Solutions.

Potassium bromide	125 grammes.
Bromine	125 "
Water sufficient to make	1000 c.c.
Caustic soda	250 grammes.
Water sufficient to make	1000 c.c.

Used by mixing equal volumes.

The accompanying table is calculated from the quantity of urea, taking 400 to 500 grains daily as a normal standard.

THE RELATION OF UREA TO SPECIFIC GRAVITY.

Specific gravity.	Per cent. urea.	Specific gravity.	Per cent. urea.
1.010	1.00	1.024	1.95
1.012	1.20	1.025	2.00
1.014	1.35	1.026	2.05
1.016	1.50	1.027	2.10
1.018	1.65	1.028	2 15
1.020	1.75	1.029	2.20
1.022	1.85	1.030	2.25
1.023	1.90		

Quantity of urine for twenty-four hours, 90 to 48 fluidounces, taking 400 to 500 grains as the normal daily quantity.

6 EAST FORTY-NINTH STREET, NEW YORK.

RECENT METHODS OF GASTROSTOMY FOR STRICTURE OF THE ŒSOPHAGUS.[1]

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THE surgery of the gastro-intestinal tract has made wonderful progress within the last fifteen years. Especially has that of the stomach been rapidly developed; and this, I believe, for the reason that not only do diseases of the stomach proper require operations on the organ, but also strictures of the œsophagus, at least in the majority of cases. In patients who suffer from a slowly but surely increasing cicatricial or cancerous stricture of the œsophagus the surgeon is called upon to perform gastrostomy—to establish a gastric fistula.

In former years every doctor who had a case of stricture of the œsophagus under his care dreaded to give his patient the advice to have the stomach stitched to the abdominal wall and opened. He generally sent the poor sufferer to the surgeon at the last possible moment, when even fluids had refused to pass the œsophagus—when rectal alimentation had become necessary. And why did the physician do this? why did he temporize as long as possible? Why did the surgeon, too, hesitate to perform the operation? Because the doctor had generally seen his patient die quicker with than without the operation; because, in most cases, the food which had been poured into the stomach through the tube in the artificial opening oozed out or even flowed back along the

[1] Read before the Medical Society of the State of New York, at its Eighty-eighth Annual Meeting.

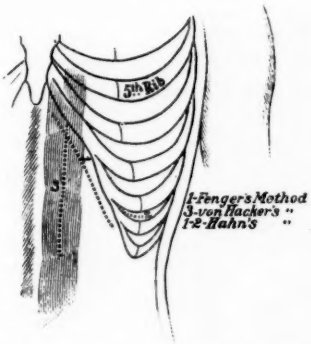
tube, so that not enough was retained to nourish the patient—the oozing, moreover, producing a troublesome painful eczema in the epigastric region; because, in one word, it had formerly been impossible to keep the walls of the fistula tightly adjusted to the tube.

This formerly well-founded reason for delay happily does not any longer hold good. It cannot be said too often and emphasized too much, for the sake of all the unfortunates afflicted with stenosis of the œsophagus, that there are at present "a number of methods" at the surgeon's disposal which enable him to prevent regurgitation from a gastric fistula. Thus the patient will nowadays certainly not die from starvation.

These recent methods have put the indication for gastrostomy for stricture of the œsophagus on an entirely different basis.

Permit me to call your attention for a moment to the old method of performing gastrostomy, generally called the "method of Fenger."[1]

FIG. 1.



An incision three inches long is made parallel with the border of the left ribs from near the median line down to the eighth cartilage (1, Fig. 1). The abdominal wall, with the peritoneum, is divided in the same line. An area of the anterior wall of the stomach about one and one-half inches long and one inch wide is attached by sutures (about 15 to 20) to the cut surface of the abdominal parietes. Loose tamponade. Rectal alimentation. Three to five days later the dressing is removed and

[1] The operation was originally proposed by Chr. A. Egeberg, a Norwegian military surgeon, in 1887; published in 1841. Charles E. Sédillot, of Paris, later of Strasbourg, gave it its name and its indications in 1846, and performed the first gastrostomy on the human subject at the Strasbourg Clinic, November 13, 1849. The operation was later modified in its details by C. E. F. Fenger, of Copenhagen, in 1853. The first successful case is that of Sydney Jones, of London, in 1875. The first case on record in America for obstruction of the œsophagus was performed by F. F. Maury, of Philadelphia, June 25, 1869; the first case in New York by A. Jacobi in 1874.

the stomach incised with a knife, between two slings, which had been put in at the time of the operation in order to identify the exact position for the opening; the latter was made very small. Hagedorn proposed to use Paquelin's thermo-cautery for making the puncture. Only if the patient were very low was the gastric fistula established at once.

CASE I.—Man, aged forty-two years. Malignant stricture of the œsophagus near cardia. Only fluids pass. Marked emaciation. November 7, 1889, gastrostomy, first part, at the German Hospital; Fenger's incision. Two days later incision with Paquelin, just large enough to give entrance to a small-sized drainage-tube. Regular feeding. A few days later beginning leakage. Tube exchanged for larger size. Soon renewed regurgitation; mechanical devices fail to make the fistula water-tight; progressive eczema of surrounding skin in spite of proper treatment with pastes, etc. Increasing emaciation. Death from exhaustion and right croupous pneumonia, November 20th.

CASE II.—Man, aged sixty years. Cancerous stenosis of œsophagus near cardia. October 16, 1890, gastrostomy, first part, Fenger's incision. October 18th, stomach opened with Paquelin. Also in this case the same annoying consequences set in. Patient slowly lost ground, and died November 16th. Post-mortem showed a croupous pneumonia of the right upper lobe.

This primitive method of gastrostomy continued the only one in use for forty years. Owing to the generally experienced ill-success of this operation, as far as the functional result was concerned, methods of surgical interference for the sake of relieving the troubles of an œsophageal stenosis fell into great disrepute.[1] To-day Fenger's method, as originally proposed, is practically abandoned.[2]

[1] A multitude of mechanical devices intended to avoid leaking have been brought out from time to time. I shall mention a few only. Von Langenbeck made use of a small rubber air-pillow with a central opening. Through it the tube, which was closed by a stopcock, passed into the stomach. The pillow was covered and held down by a piece of lead perforated in the middle and held in place by a circular elastic band. Lannelongue applied an hour-glass-shaped obturator, which could be blown up with air, the stomach-tube passing through its centre. Kappeler's assistant, Huber, constructed the following apparatus (Deutsche Zeitschr. f. Chirurgie, vol. xvii. p. 132): A tube made of horn, with an outward curve at its lower end, is split lengthwise, so that the two halves can be separately introduced and, when in place, readjusted. A wide rubber ring covers the lower trumpet-like (intra-gastric) end. It holds the tube firmly in place and avoids pressure. The upper straight part of the divided tube carries a worm and a screw-nut on its outer side. Where it emerges from the abdominal parietes it is surrounded by a small rubber air-pillow, which is held down by a metal plate screwed down upon it. Over the upper end the feeding-tube is slipped and closed by a clamp. In one of Kappeler's cases this obturator firmly closed a wide gastric fistula. Lately a glass tube of special construction has been recommended from Mikulicz's clinic. (Berl. klin. Wochenschr., 1893, No. 1.)

[2] Three years ago Terrier, of Paris, stated that he was able to avoid the egress of the contents of the stomach by making a very small incision and only introducing a tube for feeding purposes. At other times it is kept out. (Revue de Chirurgie, 1891, No. 4.) Lately T. Nicolaysen, of Christiania, similarly modified the old method. He lifts up a square-inch portion of the stomach wall to the parietes by 4 to 6 mattress sutures. They are tied over pieces of tubing after an area of the stomach of not larger than a bean's size has been stitched to the parietal peritoneum and muscles at the middle of the wound. The external wound is closed by deep and superficial sutures. Either at once or after twelve to twenty-four hours the stomach is incised. The hole is made small so as to let pass a Nélaton catheter of medium size. This is

It will be noticed that the great objection to Fenger's method was the liability to leakage from the fistula around the tube. Four methods have been recently devised to overcome this difficulty—the methods of Von Hacker, of Hahn, of Witzel, and of Ssabanejew-Frank.

1. *The method of Von Hacker.*[1] In this the operator makes the fistula through the left rectus muscle, so as to secure a sphincteric action from the tonic contraction of its fibres around the extruded portion of the stomach wall.

I shall describe the operation as I used to perform it. Longitudinal incision three inches long over the left rectus muscle, beginning about one inch below the border of the left ribs, and the same distance to the left of the median line (3, Fig. 1) Blunt dissection of the belly of the muscle—best with the handle of the knife.[2] Opening of peritoneal cavity. A fold of the anterior wall of the stomach as near to the fundus as possible is grasped with two fingers, pulled forward out of the wound, and at once secured with two slings of thin silk which embrace the serous and mucous coats of the organ. They are held by the assistants in the middle of the abdominal wound. These slings are left in the stomach, and will serve as a guide for the subsequent incision. Care is taken to let them pierce the stomach on a line parallel to its longitudinal axis. Then the incision between them will run parallel to the branches of the gastro-epiploic arteries, thus reducing hemorrhage. (This point was of some value if the stomach could not be lifted up well and the opening had to be established near the pylorus.) Now a silkworm-gut suture is passed near the upper border of the peritoneal wound through the entire thickness of the abdominal wall, including the skin, catching the stomach on its way. It is not tied. Its ends are clamped by an artery forceps. The same is done below, the stomach wall having been well stretched by the left hand of the operator, to make sure that it will afterward easily adapt itself to the peritoneum without producing folds. Then a number of silk sutures are put in on both sides—about eight or ten in all. They pass the serous and muscular coats of the stomach and embrace the entire thickness of the abdominal

kept in for three days and then removed. It is temporarily reintroduced for feeding purposes. In two cases the functional result of the direct—not oblique—fistula was perfect. If desired it can be bluntly dilated. (Forhandl. i det Norske med. Selskab. Report in Centralbl. f. Chirurgie, 1894, N. 4, p. 83.)

[1] V. Hacker: "Ueber die Verwendung des Musculus rectus abdominis zum Verschluss der künstlichen Magenfistel," Wien. med. Wochenschr., 1886, Nr. 31 u. 32; und "Ueber die Erfolge der Gastrostomieen mit Sphincterbildung aus dem Musculus rectus abdominis," Wiener. klin. Wochenschr., 1890, Nr. 36 u. 37. C. Strunz: "Ueber fünf weitere Fälle von Gastrostomie mit Sphincterbildung aus dem Musculus rectus abdominis, V. Hacker," Chirurgische Beiträge aus dem Erzherzogin-Sophien-Spital, Wien, 1892. Rep. in Centralbl. f. Chirurgie, 1893, No. 9, p. 208.

[2] Girard suggested that some of the fibres of the rectus muscle should be crossed, in order to have a still more pronounced sphincteric action. (Correspondenzblatt f. Schweizer Aerzte, November 11, 1888.) According to other surgeons' and my own experience this is an unnecessary addition.

wall, but emerge in the subcutaneous tissue. They do not penetrate the skin. (A hook-shaped needle will be found most convenient for the purpose.) These sutures are tied at once. Then the silkworm-gut sutures are tied and the angles of the wound closed by a stitch or two. The middle of the wound, about one inch long, is left open and loosely packed with gauze. Dressing of the closed portion of the wound with iodoform gauze and collodion. The patient may partake of liquid diet if he be able to swallow; if not, rectal alimentation is resorted to.

Two or three days later the stomach is opened. Within this time the wound has healed by primary union and granulation commenced in that part of it which had been packed. The stomach juice coming in contact with the wound now will not disturb healing. This is, no doubt, an important point; Von Hacker specially emphasizes it. The fistula to be made in the middle of the incision will be far more satisfactory if the rest of the wound be healed by primary union. For this reason operation in two stages is preferable, but in greatly reduced patients we should, of course, try to give immediate relief. The incision is always made with the knife, and as small as possible, just large enough to admit the smallest-sized drainage-tube. Cocainization of the stomach wall is unnecessary. The patient does not experience any pain. Generally two small arteries spurt. They are clamped and tied. (Paquelin cautery is never used for opening the stomach. With it an eschar is made, which when pushed off rapidly enlarges the hole.) A long tube is now inserted *à frottement*, and about six inches of its external extremity left projecting beyond the abdominal wall. It is closed by a stopcock. Then the surrounding wound is repacked. Now the two silk slings are removed. The tube is held in place by slipping over it down to the abdominal wall a short piece of the next larger size of tubing, armed with two safety-pins. A piece of gauze, partially incised, is pushed underneath the pins, another one with a small centre hole on top. Both are held in place by the rubber adhesive plaster straps, as used for laparotomy, or by a square piece of muslin with a small centre hole and one or two long pieces of tape on either side, which pass around the body and are tied by the patient in front.[1] Soon an ointment dressing is applied. Ten days after the operation the patient gets up.

Von Hacker's method is no doubt a very good one. If properly carried out, leakage very rarely sets in. If it does, the tube must be exchanged for one of larger size. If the largest in the market has been put in and yet some of the food regurgitates at times, the tube should be removed during sleep, the stomach meanwhile being kept empty; on

[1] Other authors keep a short tube in place by closing it with a clamp just in front of the abdominal wall, which is then held down by the dressing. I prefer the method described and the long tube. The introduction of food through the tube can be done farther from the wound without disturbing the dressing.

the following day it is replaced, and the fit will be perfect, as before. Von Hacker needed in his cases a special stomach canula with double rubber balloon (the Von Hacker-Scheimpflug canula).[1] All my patients have worn a simple rubber tube in the fistula. It fully occluded the opening. In none of these cases did eczema set in. According to my observations the small incised wound in the stomach first enlarges rather quickly; its borders are probably digested by the gastric juice. A tube three times as large as the first can be easily put in after about eight days. But soon—apparently with advancing cicatrization—the limit was reached. No larger sized tube is needed; the fistula becomes and remains patent. In one of my cases I saw the patient shortly before death—four months after the operation. He had a distressing, continuous cough, and expectorated, rather vomited, large masses of the ulcerating neoplasm. I satisfied myself that in the severest paroxysms of cough not a drop oozed out alongside the tube.

I have described the technique of this operation and its after-treatment at some length, because it gave me satisfactory results, carried out in the way described. It is a slight modification of that originally devised by Von Hacker, who opens the stomach by a somewhat larger incision, so that a tube of 6 to 8 mm. diameter can be put in. He cuts down to a needle, which is thrust through a fold of the stomach at the first stage of the operation, embracing the whole thickness of the two walls of the organ, mucous membrane included, and stitches the latter to the skin. I believe that the last-mentioned point, especially, is not preferable. It seems to me that the possibility of leaking is lessened if the stomach wall be left *in situ* after the incision, and not extruded.

Six patients with cancerous stricture of the œsophagus, all males, have been operated by me according to this method. One died in five days after the operation, in consequence of extreme weakness; two succumbed to a perforation of the growth into the trachea on the tenth and twelfth days respectively after the operation; one lived three, one four and a half, one eight and a half months after the operation. In every one of the cases the functional result was good.

Case I.—G. W., aged seventy years and six months. Admitted to German Hospital, April 4, 1891. Increasing symptoms of stenosis of œsophagus for last ten months. Fluids still pass. Sounding reveals an impermeable stricture of the cardiac end of the œsophagus. April 6th, gastrostomy, first part. Operation as above described. Liquids by mouth allowed. April 8th, primary union of abdominal wound; stomach incised with knife; opening just admits the smallest size drainage-tube; fistula closes water-tight from the beginning. April 20th, largest size tube put in; no leaking. April 27th, discharged; weight 117 pounds. Patient was presented to the New York Surgical Society on

[1] Max Scheimpflug: "Ueber eine neue Balloncannule für künstliche Magenfisteln," Wiener klin. Wochenschrift, 1888, Nr. 24 u. 25.

May 13th (*N. Y. Med. Journal*, December 5, 1891, p. 637), and to the Section on General Surgery of the Academy on October 12, 1891 (*N. Y. Med. Record*, October 24, 1891, p. 517). Had then gained considerably in weight; able to do light work. November 11th, fistula closed tightly around tube; patient swallows at times bread with butter; weight 135 pounds. In the following weeks intermittent leakage. Whenever it occurred, stomach was kept empty toward evening and tube left out during the night. On the following morning its fit was again perfect. On December 15, 1891, pneumonia set in, to which patient succumbed in three days (Isabella Home), December 18th, eight and a half months after the operation.

Case II.—N. N., aged forty-six; entered the country branch of the New York Skin and Cancer Hospital, February 9, 1892. Marked symptoms of stenosed œsophagus. February 11th, gastrostomy, first part; feeding through the mouth on liquids, with rectal alimentation. February 14th, stomach opened and tube introduced; patient in good condition. He remained so for nine days, when suddenly symptoms of perforation of the growth into the trachea set in, to which the patient succumbed within twenty-four hours.

Case III.—A. M., aged forty-seven; admitted to German Hospital, October 6, 1892. Difficulty in swallowing for the last eight months. Within the last few weeks had to be satisfied with fluid diet—even this often regurgitated; intermittent intense pain along sternum and dorsal spine; pulse weak and rapid; lost about fifty pounds; impassable stricture twelve and a half inches behind teeth. Rectal alimentation and subcutaneous stimulation preparatory to the operation. October 8th, gastrostomy, first part, working with A. C. E. mixture. Two days later stomach opened; external wound had healed by primary union; abdomen flat, painless; additional careful feeding through tube. October 12th, pulse not improved; patient very weak. October 13th, died under symptoms of heart failure.

Case IV.—O. Sp., M.D., aged fifty-seven; increasing trouble in deglutition for nine months; lived on fluids for last six months—within last few days these cannot pass; at times lancinating pains through sternum and spinal column; extreme emaciation; aphony; laryngoscope reveals paralysis of left vocal cord; infiltrated hard glands in the left supraclavicular region. Sounding omitted on account of previous repeated hæmatemesis. Admitted to German Hospital, January 7, 1893. Gastrostomy, first part; morphine-chloroform narcosis. January 9th, stomach incised; smallest size tube put in. January 12th, patient able to drink. Ten days later the largest size passed; no leaking; careful feeding; patient up and about. February 1st, discharged. Abdominal wall closed firmly around tube. Patient was presented before the Scientific Society of German Physicians, March 24, 1893 (*N. Y. Med. Monatsschrift*, 1893, No. 2, p. 450). General condition satisfactory. In the second half of April he began to cough; for more than a week he expectorated, without accompanying hemorrhage, large masses of the ulcerating neoplasm, thereby regaining the use of his voice and temporary ability of deglutition. Patient was regularly seen by me during this time. He had distressing paroxysms of cough, but at no time any loss of gastric juice alongside the tube. The sphincteric action of the rectus muscle was perfect. Patient died of marasmus May 20, 1893, four and a half months after the operation.

CASE V.—A. S., aged forty-three; admitted to German Hospital, January 5, 1893. For one-half year increasing symptoms of strictured œsophagus; lately liquid diet only; pain in region of cardia, where solid food is arrested; cachexia. January 9th and 13th, gastrostomy, in two stages. February 12th, patient in good condition; has gained in weight and strength; tube fits very well. March 8th, presented before the New York Surgical Society in good general condition (*Annals of Surgery*, May, 1893, p. 592). Could now and then swallow bread and chopped meat, at other times not even fluids. He had lately learned to chew his food and make it slippery with saliva and then blow it through the large tube into the stomach. He gave up this procedure later because of the consecutive very annoying pressure in the stomach caused by the amount of air that had been blown in with the food. To get rid of some of that pressure he had to lie down, raise the tube perpendicularly and remove its stopcock. Patient left the hospital March 11th. He died of increasing marasmus in the first days of April, three months after the operation.

CASE VI.—E. R., aged fifty-two; admitted to German Hospital, January 4, 1893. Since last October rapidly increasing hindrance in swallowing; sound meets a slight resistance seven inches, and a second impassable one twelve inches, behind teeth; a hard, movable, aching tumor of goose-egg size, especially painful on pressure, in the left fossa supra-clavicularis, reaching underneath the clavicle. Has lost considerably. January 11th, gastrostomy. January 14th, abdominal wound healed without reaction; stomach opened. January 21st, 6 A.M., sudden intense dyspnœa. Expired one hour later under symptoms of perforation of the growth into the trachea.

2. *The method of Hahn.*[1] Published in 1890; first performed in June, 1877.

Fenger's transverse incision; peritoneal cavity opened in same line; second cut in the eighth intercostal space (1, 2, Fig. 1). Parietal peritoneum is punctured at this point by forceps or knife and enlarged by spreading forceps. A fold of the stomach is drawn through the space with a dressing forceps and fastened by stitches between the two cartilages.

Hahn performed the operation eight times up to 1890, and was pleased with its results. He affirms that diaphragm and pleura will not be injured, and believes that the cartilages of the ribs act like a sphincter or stopcock. Von Hacker saw in two cases, Dalton (St. Louis) in one, erosion of the cartilage of the ninth rib follow the operation. It did not, as it seems, come into favor.[2]

3. *The method of Witzel.*[3] Published in 1891. In this method the

[1] Eugen Hahn: "Eine neue Methode der Gastrostomie." Centralbl. f. Chirurgie, 1890, No. 11, p. 193.

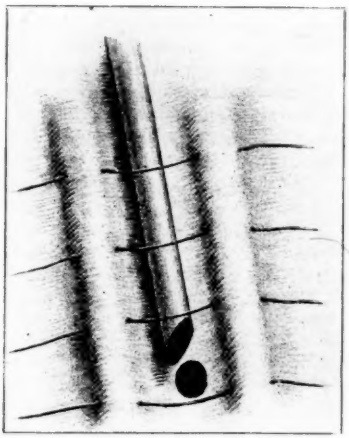
[2] This operation has lately been slightly modified by A. Cocchereli, of Parma. Incision in seventh intercostal space inward of axillary line only through skin. Later pulled downward. Division of eighth intercostal space; peritoneal cavity opened. Fold of stomach pulled forward and stitched to peritoneum below eighth rib. Stomach opened and sutured to skin-wound. This latter part of the operation is done, if possible, on fifth or sixth day after the operation.

[3] Oscar Witzel: "Zur Technik der Magenfistelanlegung," Centralbl. f. Chirurgie, 1891, No. 32, p. 601.

fistula passes through both the rectus and the transversalis muscles, whose fibres, running at right angles to each other, may be expected to contract still more efficiently than the rectus muscle alone. The second important feature of this operation of Witzel's is the infolding of the tube in the wall of the stomach, which is stitched over it so as to form an oblique canal.

Fenger's oblique incision through the skin and subcutaneous tissue. Longitudinal incision of the sheath of the rectus muscle. Blunt separation of the rectus and underneath of the adjacent transversalis parallel to the direction of their fibres. They are held apart by large blunt hooks. Division of the peritoneum obliquely. The stomach is drawn out in front of the wound, its margins being packed with sterilized gauze, and at once incised by a very small hole toward the cardiac extremity (Fig. 2). Into this opening a snugly-fitting rubber tube (of

FIG. 2.



about 25 to 28 French gauge) is introduced and then buried in the wound of the stomach (infolded) to the extent of about one and one-half inches by stitching over it two folds of the stomach wall (double row of Lembert sutures), as seen in the diagram (Fig. 3). These folds run from the left down to the right and upward, parallel to the external wound. Special care must be taken to put a few stitches beyond the entrance of the tube where a small groove is formed (see Fig. 4).[1] The entire area is then stitched to the edges of the peritoneal wound by interrupted sutures, thus rendering the operating field extra-peritoneal. Then the

[1] Instead of the twelve sutures marked in the diagram (Fig. 4), there should be about four to six.

large hooks, which hold the muscles apart, are removed. The latter return to their former position and hold the tube between themselves like a double (natural) clamp. The edges of the abdominal wound are sutured by silkworm-gut or silk up to its inner border where the external end of the tube emerges.

FIG. 3.

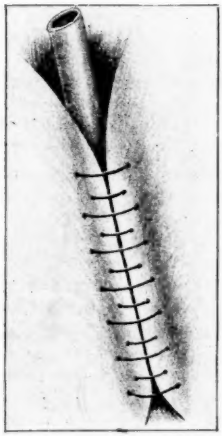
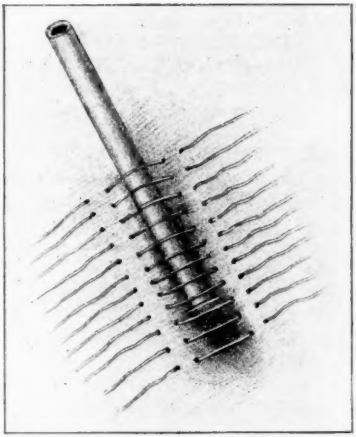


FIG. 4.



Witzel had thus operated on two patients for malignant stricture of the œsophagus with perfect success. The patients were fed through the tube immediately after the operation. At no time was there any leakage. He even removed the tube after nourishment had been poured into the stomach and reintroduced it temporarily when the next meal was due. The patient remained perfectly dry.

In January, 1893, Mikulicz had published by his first assistant, Von Noorden, five cases which had been successfully operated upon in this way: four for cancerous and one for cicatricial stenosis of the œsophagus.[1] In every one of the patients the tube fitted absolutely tight immediately after the fistula had been established.

In perusing the recent literature I see that the next cases of this kind published are my own, three in number.

CASE I.—A man, aged fifty-nine years, was admitted to the German Hospital, January 21, 1893. Difficulty in swallowing began about one year ago and had continued to increase; within the last days fluid

[1] Berliner klin. Wochenschrift, 1893, No. 1. In a postscript Mikulicz states that within the last two months the operation according to Witzel had been performed a few more times, always with the same satisfactory result.

refused to pass. There was great emaciation, and diffuse putrid bronchitis existed. A bougie was found to meet resistance near the cardia. January 23, 1893, gastrostomy was performed, strictly following Witzel's description.[1] The rectus and transversalis muscles were bluntly divided. A tube of 28 French gauge was used, and was buried in the wound for about one and three-quarters inches. The patient stood the operation very nicely. Some fluid poured in through the tube after the operation did not regurgitate. Later, feeding at regular short intervals. In spite of very frequent and hard coughing spells, there was not the slightest regurgitation at any time. A small strip of iodoform gauze had been put alongside the tube at the time of the operation, before the external wound was closed by stitches; this was removed on the third day. The wound had healed by primary union throughout.

According to Mikulicz's advice, the patient was kept flat on his back for a few days after the operation, in order to favor a proper working of the fistula. This, I believe, was a mistake. With my present experience I should have let such a patient sit up at once, to prevent pulmonary complications. On the third day after the operation the temperature suddenly rose and pneumonia developed. He died on January 26th, five days after the operation. Post-mortem showed bilateral pneumonia; no symptoms of peritonitis.

The specimen, which is of great interest, was presented to the New York Surgical Society, March 13th.[2] (See Fig. 7.)

Case II.—A woman, aged thirty-five years; first experienced difficulty in swallowing seven months ago. Admitted to German Hospital, February 24, 1893. An elastic bougie meets obstruction near the cardia. She had lost flesh considerably within the last few months. Great weakness. Pulse, 120. Marked gastrectasia. Enteroptosis. Immediate operative interference indicated, as fluids also were regurgitated. Operation February 26, 1893. Muscles bluntly divided. Rectus small. Incision covers a portion of external and internal obliques, which were also separated in the same way. Stomach very large. Easily pulled in front of the wound. Tube infolded for about two inches. Operation took longer than anticipated on account of some difficulty encountered in lining the field of operation with peritoneum at the lower angle of the wound.[3] Here a small strip of gauze was introduced into the peritoneal cavity for drainage, also alongside the tube. The latter was fastened with a silkworm-gut stitch to the skin, where it emerged. Rectal alimentation during the first twelve hours; then direct feeding through tube. No regurgitation. No tenderness over abdomen. No tympanites. Stimulation. Patient did not rally, however. She gradually sank, and died from heart-failure thirty-six hours after the operation.

Case III.—A man, aged fifty-six years, entered the German Hospital

[1] I believe that this was the first case of this kind operated on in this country.

[2] Annals of Surgery, May, 1893, p. 595.

[3] I believe that the difficulty was caused by infolding a longer portion of the tube than is necessary. One and a half inches will, it seems, be sufficient for producing a well-closing canal.

for stricture of the œsophagus, on March 16, 1893. He had acquired specific disease at the age of twenty-six. He first noticed difficulty in swallowing four years ago. One year later he came under the care of Dr. Max Einhorn, of this city. The latter had sounded him and found a stricture behind the bifurcation of the trachea. Under the use of iodides the patient improved greatly for a time, being soon again able to swallow all kinds of food. Every six to eight months the stenosis again manifested itself, but always yielded to anti-specific treatment. The latter consisted mainly of the iodides, as mercury always produced a marked and obstinate stomatitis. Three months ago he suddenly developed great difficulty in deglutition. Could not even drink fluids. Again a short turn for the better took place. Yet he followed advice and entered the hospital for an operation. Whilst there, he was suddenly attacked by a broncho-pneumonia, March 23d. There were râles all over the lungs, and marked bronchial breathing posteriorly over the right lower lobe; temperature ran up to 104°; extreme weakness. Quite suddenly the passage down to the stomach was again blocked for semi-solid food; only small quantities of fluid passed. I had to resort to rectal alimentation and strong subcutaneous stimulation. Luckily the fever dropped at this time, and soon a small amount of fluids could be swallowed again. On April 13th I could dare to submit him to Witzel's method of gastrostomy. Rectus muscle (fairly developed) is bluntly divided. Anæsthesia badly borne; there is continuous retching and coughing; pulse weak and rapid. The lower end of the operating-table was raised and the operation done throughout in this posture. In order to save time the oblique and transversalis muscles were divided with the knife according to the old Fenger's incision. Stomach rapidly found and pulled out. A 28 French-gauge tube was easily introduced and infolded, and the operating field lined with peritoneum. As some stomach juice had oozed out of the small incision during one of the strong paroxysms of cough, just when its borders were held aside with small sharp hooks in order to let the tube pass, a small strip of iodoform gauze was introduced through the lower angle of the wound into the peritoneal cavity, for safety's sake, and passed out between two of the silkworm-gut sutures which closed the external wound. Another small tampon was put alongside the stomach-tube. It emerged out of the median angle with the latter, which was secured there to the skin by a loosely tied silkworm-gut suture. Dressing. Feeding through the tube after a few hours. Patient was at once kept in a sitting position in bed to avoid further complications of the lungs. Nevertheless, signs of pneumonia with rise of temperature developed on the next day in the same area which had been attacked before. Patient coughed almost continuously. No better opportunity could be desired for demonstrating the brilliant functional result of this operation. It can be asserted that not a drop escaped from the stomach alongside the tube at any time. The wound healed kindly by primary union. The two tampons were removed after forty-eight hours. The lung trouble slowly subsided. Patient made a good recovery. He was presented to the New York Surgical Society on May 10, 1893.[1] He had taken his supper two hours before. The tube was removed and the man made to cough as hard as he could. Not a bit of stomach contents was pushed out. The

[1] Annals of Surgery, November, 1893, p. 555.

skin around the fistula was, and is, up to date, in perfect condition. (See Figs. 5 and 6.) I noticed at that time, and do so still, a slight

FIG. 5.

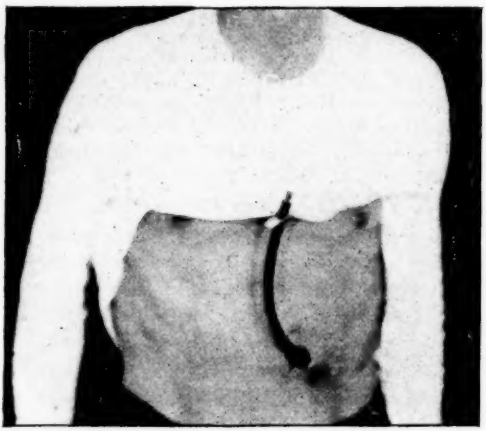
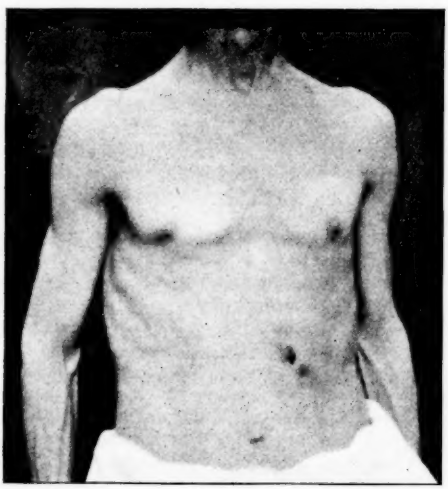


FIG. 6.



resistance when, on reintroduction, the tube enters the oblique canal which has been made through the stomach wall. This resistance is cer-

tainly due to contraction of the muscular part of the stomach wall. Patient was at the time of the presentation able to swallow bread and meat. This condition lasted for about four weeks, when within a few days the stenosis was found to be again impermeable. The passage became suddenly free twice since that time—on October 20th, and again on January 20th of this year. In October it occurred after a very severe paroxysm of cough, and lately after a hard sneeze. Each time semi-solid food could be well swallowed.[1] This enjoyable condition lasted about three weeks, when the old blockade reappeared. To-day the patient is in good general condition. He has gained flesh since the operation. He weighs now 126 pounds; before the operation, 113. I cannot yet endeavor to state the real cause of the stenosis. It seems to me impossible to pronounce it a syphilitic stenosis. Spasm and extra-œsophageal intermittent glandular swelling can, I believe, be excluded. It is also improbable on account of the long standing of the trouble, that a malignant growth has developed on the basis of specific scars or ulcerations. I am rather inclined to believe that the œsophagus is bent laterally behind the bifurcation of the trachea, held down to one side by extra-œsophageal contracted tissue. A diverticulum has probably formed at this spot. (The case resembles very much that reported by Maury in THE AMER. JOURN. OF THE MED. SCI., April, 1870, p. 365.)

As the patient is quite satisfied with his present condition, I have not yet interfered, in order to watch the further development in the function of the fistula, which so far is admirable. I hope to be soon able to report something more definite about the exact pathological condition and probably also of the curative factor in this interesting stenosis.[2]

Lately, W. W. Keen, of Philadelphia, has published a case[3] where he performed Witzel's method of gastrostomy in a man aged forty-eight years, for a primary cancer of the œsophagus. He was able to fully corroborate what had been observed by Witzel, Mikulicz, and myself. He also found the operation "effectual in preventing any leakage."[4]

Most probably other surgeons have meanwhile resorted to this method

[1] A sound passed into the œsophagus at the time was stopped at the same spot as formerly, 10 to 10½ inches behind the teeth. The attempt at letting the patient swallow a perforated shot on a silk thread was also frustrated. If the manœuvre had succeeded, it had been my intention to localize the shot with the cystoscope, or in the empty stomach with the help of a urethral tube and head-mirror, catch it with a forceps, pull it out of the fistula and then use the thread for retrograde dilatation by tying tubes to its end.

[2] On February 20th I washed out the stomach and filled it with ten ounces of water, removed the tube, introduced the cystoscope, and searched for the cardia. I found it and introduced an elastic bougie into the œsophagus under the guidance of my eyes. About three to four inches up it was held by an impassable resistance.

Meanwhile the patient died of broncho-pneumonia at the German Hospital, April 30, one year and seventeen days after the operation. *Post-mortem:* Cancer of the œsophagus behind bifurcation of trachea; communication of œsophagus with right bronchus; inner aspect of gastric fistula corresponds to the picture as shown in Fig. 7, cone, however, less projecting; there are a number of radial folds of the mucous membrane around the inner opening.

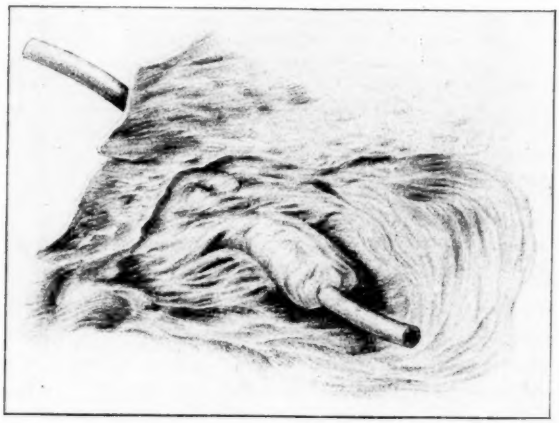
[3] "Gastrostomy by Witzel's Method for Primary Cancer of the Œsophagus." Annals of Surgery, December, 1893, p. 638.

[4] Another successful case in a man of seventy-two has lately been reported by Dudley Tait. Paper read before the California Academy of Medicine, May, 1894. Pacific Med. Journ., June, 1894.

in proper cases. They have not, however, as far as I could find, published their experience.

Witzel's method is an excellent one. It is, beyond doubt, the best known. It is "simple, moderately rapid," and prevents leakage and its distressing sequelæ with "absolute certainty," even when the tube is

FIG. 7.



removed. By infolding the tube, the entrance of the latter into the stomach is rendered oblique. Thus an organic valve is artificially formed. This explanation of Witzel is fully justified by the specimen obtained from my first patient. The condition is identically the same as found at the post-mortem of one of Mikulicz's cases. As seen in Fig. 7, which is drawn from the specimen, a short artificial cone obliquely protrudes into the lumen of the stomach. It is formed by the stomach wall itself, and is produced by the peculiar and ingenious mode of stitching the same over the tube. At its tip the tube emerges. It is evident that even when the rubber tube is removed, the intra-gastric pressure must close this internal entrance to the fistula by pressing its two walls upon each other. Mikulicz observed that in the course of time the outer and inner openings approached each other, so that the tube later enters the stomach rather in a straight sagittal direction, not, as at first, obliquely. Still, it worked to perfection. I did not experience this change of direction in my third patient, who has worn his tube now for almost ten months. It still passes the abdominal parietes obliquely, yet not quite so much as at first. This, however, is due to a superficial ulceration in the line of incision near the median angle which occurred about three months after the operation. Slowly the scar, which at this

place involved skin and subcutaneous tissue only, gave way. At present the tube leaves the scar at about the junction of its middle and inner thirds (see Fig. 6). The angle formed by the tube with the anterior abdominal wall is still 45°.

It is worth recording that Witzel suggested, in his first article, the same operative procedure for establishing a suprapubic vesical fistula. Zweifel, of Leipzig, was the first to carry out this idea, May 2, 1893, in a woman of thirty-eight years who had carcinoma of the urethra. (*Centralbl f. Chir.*, 1893, No. 37, p. 785). He extirpated the entire infiltrated canal, with a portion of the bladder, closed the latter by suture, and made a suprapubic artificial urethra, using, after laparotomy, the posterior wall of the bladder where it is covered by peritoneum. The result was ideal. Martin, of Cologne, successfully did the same operation on the extra-peritoneal suprapubic part of the bladder for pronounced hypertrophy of the prostate with retention, in a man of sixty-seven years (*Centralbl. f. Chir.*, 1893, No. 47, p. 1026). The functional result was all that could be desired. Wiesinger, of Hamburg, had a similar success in a woman of seventy years, on whom he had to operate for cancer of the urethra and the fundus of the bladder; also in anumber of patients who suffered from hypertrophy of the prostate. (*Centrabl. f. Chir.*, 1894, No. 22.) I personally tried the method on a patient of seventy-three years, with retention (due to hypertrophy of the prostate) and a large encysted stone, at the German Hospital (January 30, 1894). Suprapubic cystotomy was done, the stone removed, and the bladder closed by a double row of sutures down to lower angle of the vesical opening, where a soft rubber catheter was introduced. The latter was then infolded for about one and one-half inches, after Witzel's method; permanent drainage. Splendid functional result for the first two days; then, during a passage from the bowels, the lower end of catheter pushed out of the bladder. It had been purposely fastened to the outer skin only. Reintroduced; no leakage. Two days later the same accident; again replaced. This repeated manipulation spoiled the result. Patient now cured, with tightly closing wound around catheter. On August 20th I made use of the method in a man of sixty-five years of age with retention due to hypertrophy of the prostate. So far the result is extremely satisfactory. In a recent article, Witzel states that he had used his method of making an oblique fistulous canal with very good success in a lady for an enormous hydronephrosis. He advises the making use of it also in cases where the gall-bladder needs permanent drainage, and where a temporary artificial outlet must be given to the contents of the small intestine (*Centralbl. f. Chir.*, 1893, No. 47, p. 1025).

A few points referring to this method of operating, as observed in the case of the last patient with the lapse of time, may be mentioned here.

If the stomach be very much distended, one and one-half pints to one quart having been poured in and the tube then removed, about one-half to one ounce first runs off, mixed with some bubbles of air. Then, suddenly, the outpour ceases. Even strong cough does not throw out a drop. This phenomenon is easily explained. In the very distended stomach the internal cone runs more in a sagittal line. If the tube be extracted, a sufficient amount must first be expelled before the canal again takes its oblique direction, thus producing the valve. But as soon as this is the case, the intragastric pressure at once shows its effect. If the tube be left in place, the fistula is always patent, no matter how much fluid is poured into the organ.

Another feature which is very marked in my case is the rapid contraction of the canal after the removal of the tube. It has happened quite often that the man coughed the tube out over night in one of his frequent severe cough-paroxysms, and, timid as he is, did not dare to at once replace it. When he then came to my office the next morning, the walls of the fistula had perfectly approached each other. (A urethral steel sound of the size of the tube pushed into the stomach always sufficed to make room for the tube.) For this reason I did not allow the patient to remove the tube temporarily and reintroduce it for each feeding, as Witzel did in one of his patients. Keen also "had tried to remove the tube temporarily in his patient, but had to abandon it from the difficulty of its reintroduction." Perhaps this rapid contraction is, in my case, due to the cicatricial tissue which had formed around the tube on its way through the abdominal parietes. As stated above, the muscles had been divided with the knife, and, of course, retracted at the time of the operation. However, the active contraction of the bluntly divided muscles of the abdomen will no doubt generally produce the same effect. I therefore believe we will do well in warning our patients not to leave the tube out for any length of time. They will then certainly not be in need of medical help.

I further mention as an interesting phenomenon that as long as the man was obliged to feed himself through the tube only, he had a ravenous appetite, but when he could swallow by the mouth the appetite was at once markedly diminished. When the œsophagus is obstructed, the patient brings up large masses of saliva and mucus about every half-hour. Sometimes the irritation of its presence above the stricture is not sufficient to produce a retrograde reflex spasm of the œsophageal muscles. Then the patient complains of a heavy, annoying pressure in the region of the bifurcation of the trachea. He tickles his throat with a feather until he throws up these masses, then generally mixed with some of the material that had been poured into the stomach. It seems to me most plausible that "the want of satisfaction of the sense of taste," which Keen also mentions, is the cause of the often observed constant hunger in patients with an impermeable stricture of the œsophagus, also after the gastric fistula has been established. For this reason we should induce patients of this kind to chew the solid food, and then either spit it out and have it washed into the stomach through a funnel, or blow it directly in through the tube themselves. This latter procedure I had done in one of my cases operated upon according to Von Hacker's method. As mentioned above, the patient did not like it, however, on account of the heavy pressure which was caused by the air blown in with the food.

I might here briefly discuss two points of the operative procedure. The blunt division of the rectus and transversalis muscles corresponding

to the direction of their fibres. Is this a point of vital importance? Can it always be carried out? In my first case the man, a laborer, had not a particle of fat left, but a splendidly developed muscular system. Almost the entire length of the oblique incision struck the left rectus muscle. It was divided with the scalpel-handle in its middle, and the two parts then drawn aside with two large blunt hooks. Then the transversalis was divided, following the direction of its fibres. The operation could be easily finished. However, the assistants assured me that it required all their force to hold the hooks sufficiently apart. In my second case the rectus was very small. The incision also traversed the oblique. I divided all four muscles bluntly, and had them held apart. I found great difficulty in stitching the stomach to the lower (outer) corner of the peritoneal wound. In carrying out this point to the letter, I certainly wasted some valuable time, which, considering the reduced condition of the patient, was not immaterial. In my third case I began the operation also with the intention not to cut the muscles. However, I noticed soon that I would have to divide the rectus muscle almost three-quarters down to the umbilicus, in order to gain the necessary space. I therefore divided the rectus muscle bluntly and then cut the other muscles with the knife, leaving the two parts of the rectus muscle out of the grasp of the hooks. When the intra-abdominal work had been completed, the external portion of the rectus fibres was lifted, and the tube passed underneath. I believe that this was unnecessary. The patient has now been under observation for ten months. His fistula is absolutely patent. I should therefore say that the final result of this operation will not be impaired, as far as its functional result is concerned, if the oblique and transversalis muscles be divided with the knife in the line of the incision. Of course, if blunt division be feasible, it should always be carried out. (It will be easier if we make the incision through the skin obliquely, and straight instead of curved parallel to the border of the ribs.) Thus, as Witzel emphasizes, will be avoided the formation, arising from the retraction of transversely divided muscles, of a dead space between the fixed portion of the stomach and the skin, which slowly has to fill up with cicatricial tissue. I also believe that the tube is more firmly held in place, and does not so easily glide out of its position in consequence of a coughing or sneezing spell, if compressed by the tonic contraction of muscular fibres that cross each other at right angles.

Is it necessary to line the field of operation on the stomach with parietal peritoneum? This certainly will guard against peritonitis by placing the same extra-peritoneal, and should therefore be done. How? If we make use of the interrupted suture—as Witzel seems to have done, and as I did in all my three cases—this part of the operation is time-robbing. In future cases I should first secure both angles of the peri-

toneal wound with a silkworm-gut suture, piercing the entire abdominal wall and catching the wall of the stomach outside of its operating field. These sutures are then held on the stretch without being tied, and a continuous suture is rapidly run from one end to the other on both sides. Perhaps even that is superfluous. Keen (*loc. cit.*) put three stitches through the stomach and then lifted it up by pushing the needle through the entire thickness of the abdominal parietes.

4. Ssabanejew-Frank method (previously called Frank's method). In this operation a cone of the stomach is drawn up out of Fenger's incision under a bridge of skin to a point above the border of the ribs, where it is fixed and opened.

I append the names of the two authors to this operation, because it appears, on perusing the literature, that J. F. Ssabanejew, of Odessa, devised and performed the identical operation[1] as early as May, 1890, and it was first done by R. Frank, first assistant of Albert, in Vienna, on November 23, 1892. The latter's patient was presented to the Imperial Society of Physicians of Vienna, December 9, 1892.[2] There is no doubt that Frank conceived the plan for the operation, being unaware of Ssabanejew's former similar procedure.

The operation is as follows: Fenger's oblique incision, pretty close to and parallel with the costal cartilages. The muscles should be bluntly separated according to the direction of their fibres. After dividing the peritoneum the stomach is drawn forward and a cone, of about one to one and one-half inches high, of the anterior wall of the stomach from near the fundus, held outside and in front of the wound with the help of one or two silk slings. The edges of the incised peritoneum are now stitched to the stomach around the base of this cone. Thus the peritoneal sac is at once closed. (Fig. 8.) Frank advises to also stitch the divided muscles to the stomach in order to strengthen and remove tension from the first row of sutures. A second incision is now made above the border of the ribs, three-quarters to one inch long and about one and one-quarter to one and one-half inches apart from the first one. It only penetrates the skin. The interposed bridge of skin is bluntly undermined, and the stomach cone pulled underneath it and out of the upper wound with the help of the silk slings. (Fig. 9.) The wound of the abdominal wall is closed and the stomach incised with the knife for about one-half inch (very handily done between the two slings), and stitched to the skin. (Fig. 10.)

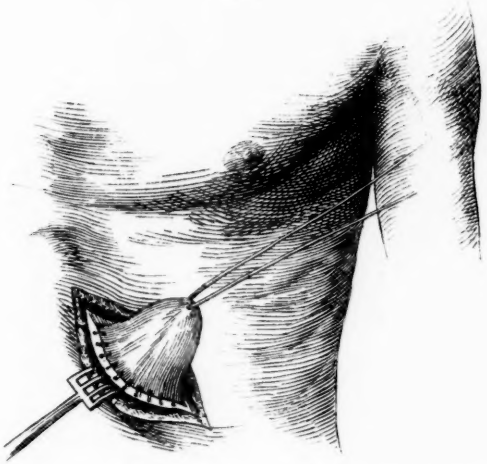
Ssabanejew has done the operation four times for cancer of the

[1] J. F. Ssabanejew, Odessa: "Ueber die Anlegung einer röhrenförmigen Magenfistel bei Verengerungen der Speiseröhre," Vratch, 1890, No. 39; and Chirurgitscheski-Vestnik, June, 1893, published in the Russian language. Cf. Report in Centralblatt für Chirurgie, 1893, No. 40, p. 862.

[2] Rudolf Frank: "Eine neue Methode der Gastrostomie bei Carcinoma œsophagi," Wiener klinische Wochenschrift, 1893, No. 13.

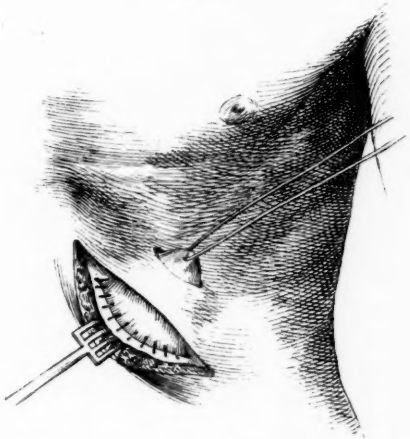
œsophagus. The patients lived from four days to ten months afterward. Their general condition greatly improved for some time. Regurgitation

FIG. 8.



through the fistula could be easily prevented. In two cases the autopsy showed the gastric fold firmly healed in its new position. Its nutrition

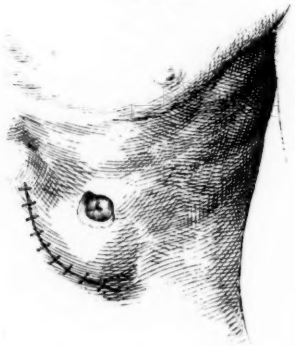
FIG. 9.



was not impaired by the curving and tension. The fistula was two to three inches long.

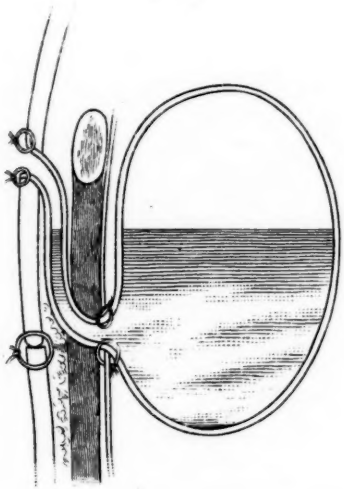
Frank reports four cases. Every one was successful also as far as the working of the fistula was concerned. He explains the favorable mechanical effect of this operation as follows: "As in Hahn's opera-

FIG. 10.



tion, the external opening of the fistula is raised; only if the stomach be filled to a great extent does the level of its contents reach the line which corresponds to the external opening (see Fig. 11). The incised

FIG. 11.



gastric cone is bent over the border of the ribs; the bridge of skin covering the cone compresses it. In all of Frank's cases the fistula

closed absolutely water-tight at all times without the use of a special apparatus. Only for the purpose of feeding was a catheter or drainage-tube introduced. Immediately afterward the patients could freely move around without losing anything of the stomach contents. No complaints were made on account of the drawn-out wall of the stomach. Frank adds that the principle brought out in the operation, namely, to let the fistulous canal pass the abdominal parietes in a curved direction underneath a stretched cutaneous bridge, might also be useful in cases of colostomy for cancerous rectal stenosis.

My own experience has been derived from the following three cases:

CASE I.—A man, aged sixty-seven years, lately treated for cancer of the pylorus, had brought up everything, fluids included, within the last eight days; intense emaciation. Admitted to the German Hospital, April 17, 1893. Stenosis near cardia; impassable. Operation, April 20, 1893. On account of the deep concavity of the abdomen the cone could not be pulled farther, in the strongly built man, underneath the skin-bridge than about one-half inch over the border of the ribs. There it was opened and incised; a tube was introduced. Immediate feeding. No regurgitation. Patient died of heart-failure the following day. I believe that here general narcosis had been contra-indicated; I should have used cocaine anæsthesia.

CASE II.—A man, aged sixty-one years, had symptoms of malignant stricture of œsophagus since last spring. On entering the German Hospital, April 17, 1893, he was very low, emaciated, and anæmic. Not a drop of water passed down. Rectal alimentation and stimulation—the latter also subcutaneously—preparatory to the operation, which was done April 24, 1893. Stomach greatly contracted; it could not well be drawn forward. Nevertheless the operation was finished without special difficulty. Skin bridge a little more than one inch wide. Second incision about three-quarters of an inch above border of the ribs. Patient stood the operation well. Lower wound healed by primary union. As a consequence of the undue traction exerted upon the attachment of the skin, a part of the lower circumference of the opening in the stomach somewhat retracted, and the upper wound, which had originally been made at least three-quarters of an inch above the border of the ribs, was pulled down below this border. Yet the result was good. I believe that undue tension can be avoided by putting a stitch of silkworm-gut through the entire thickness of the abdominal wall at both angles of the peritoneal wound, catching on its way a portion of the stomach. They are not tied until the stomach has been stitched to the peritoneum all around. They will hold the stomach thoroughly up to the abdominal wall, preventing traction on other sutures. Patient made a good recovery. He was presented to the New York Surgical Society on May 10, 1893.[1] He did not wear a tube except at the time of feeding. A large tube of almost a thumb's size is then always easily introduced. When presented, the patient had a full stomach; more water was added, and the man was then ordered to cough hard. Not a drop escaped. The functional result was certainly all that

[1] Annals of Surgery. November, 1893, p. 55.

could be desired. Patient died on June 14th, in consequence of cancerous cachexia.

Case III.—H. S., a boy, aged four years, with impassable cicatricial stenosis of the œsophagus. Gastrostomy according to Von Hacker had been performed by Dr. Gerster for the sake of retrograde sounding and cutting with the string (Abbe), July 20, 1893. Feeding through the fistula. Considerable leakage from the stomach. Three days later the gastric opening was closed. The external abdominal wound healed by granulation. For a time the boy was better, when, about September 1st, a sound again refused to pass the stricture. He lost ground steadily. Patient then came under my care. Ssabanejew-Frank operation October 3, 1893. Stomach found fixed to the parietal peritoneum by very dense adhesions. It was freed for an area of about three inches, then its anterior wall pulled forward, the cone passed under a skin-bridge of about one and a quarter inches in width, and opened. There was great tension. In order to stitch the stomach to the lower circumference of the upper wound, a short longitudinal cut had to be added, thus making a T-shaped incision. Boy stood the operation nicely; but there was almost continuous leakage in spite of all trials to prevent it. On account of the complications presented in the case, this unsatisfactory functional result cannot well be brought forward against the value of the operation.

In reviewing the three operations advisable for gastrostomy—those namely, of Von Hacker, Witzel, and Ssabanejew-Frank—with reference to the usefulness and indication of each, we must pay attention to the character of the stenosis.

1. *Cicatricial.* Here the gastric fistula must be temporarily established if regular sounding from the mouth or from an artificial œsophageal lip-fistula in the neck[1] does not succeed, or succeeds only up to a certain degree of dilatation. This is especially experienced in treating long tubular strictures of the thoracic portion of the œsophagus. In such cases the surgeon performs gastrostomy—

a. For retrograde blunt dilatation, which, if successful, is later substituted by sounding from above.

b. For the purpose of enabling him to strive for a radical cure, viz., to divide the stricture (internal œsophagotomy) and then stretch it with sounds.

The stricture can be cut with small knives on a string, pulled through from below (Lange), or with a straight urethrotome introduced from an œsophageal fistula in the neck, after careful disinfection of the stomach and of the portion of the œsophagus below the fistula in the neck (Willy Meyer, *loc. cit.*), or with a string (Abbe).[2]

[1] Graser: "Zur Behandlung der Œsophagus-Stenosen," Verhandlungen der Deutschen Gesellschaft f. Chirurgie XIX. Congress, 1890, p. 136. Willy Meyer: "External Œsophagotomy in the Operative Treatment of Cicatricial Stricture of the Œsophagus; with a Proposition for Improving the Method of Performing Internal Œsophagotomy," N. Y. Med. Journ., 1892, p. 561.

[2] "A New and Safe Method of Cutting Œsophageal Strictures," N. Y. Med. Record, February, 1893, p. 225.

Internal œsophagotomy (cutting with a knife) is considered a dangerous operation up to the present date. This mainly on account of the surgeon's inability to properly disinfect the operating field; next on account of the danger of perforating the canal, injuring an adjacent vessel or nerve, etc., and setting up acute posterior mediastinitis. The first danger can be averted by carrying out the proposition made by me in 1892 (*loc. cit.*), viz., to add gastrostomy to external œsophagotomy. The safest radical method seems to be Abbe's operation—to relieve the œsophageal stricture by cutting with a string. It has to be proved yet, however, by a series of cases, that this method also properly and safely divides, with the hope of a permanent cure, a long tubular stricture of the thoracic portion. No doubt the two cases presented by Dr. Abbe to the New York Surgical Society [1] will induce surgeons to try his procedure before all others in cases that need an operation.[2]

But is there any way of avoiding the development of a marked cicatricial stenosis of the œsophagus, with its terrible suffering and sometimes incurable consequences for the patient?

In 1887 Maydl,[3] of Vienna, proposed to perform in such cases gastrostomy as early as possible—very soon after the acid or caustic lye, etc., has been swallowed. In this way the food would not pass over the intra-œsophageal ulcerations—the continuous chemical and mechanical irritation would be avoided. Fluids might be swallowed; they would help to wash off the surface. Of course, cicatricial tissue would nevertheless be formed; there would also be the same tendency to its re-contraction; a stricture would form if matters were left to themselves. But by proper and "timely" sounding from below and above most probably can be avoided the narrow, twisted, often impermeable stricture which confronts the surgeon in almost every instance if no operation be performed.[4] In view of the brilliant functional results obtained by Witzel's method, Mikulicz has again taken up this idea. He believes that "It will be wisest in severe cases of burn of the œsophagus to establish a gastric fistula *early*, to protect the reparative process inside the canal against the disturbances caused by the passage of the food." In his one case mentioned above, where the elastic bougie did not pass any longer (for five days), swallowing became easier without help four weeks after the operation. Now a bougie cure, from above, was feasible and was suc-

[1] Report of New York Surgical Society. Annals of Surgery, July, 1893, p. 37, and January, 1894, p. 88.

[2] See also, W. T. Mayo: "Stricture of the Œsophagus; Division and Dilatation after Gastrostomy and Œsophagotomy; Testimony as to the Value of Abbe's String Method of Division," N. Y. Med. Journ., April 7, 1894, p. 433.

[3] "Die Magen-Chirurgie der letzten fünf Yahre," Internat. klin. Rundschau, 1887.

[4] Von Hacker proposes to start sounding of the œsophagus with the help of this gastric fistula, two or three weeks after the accident. Ueber die nach Veractzungen entstehenden Speiseröhren-Verengerungen. Wien, 1889, p. 121.

cessful. One month later semi-solid food passed with ease. The tube was removed from the stomach. The fistula closed spontaneously without further interference within sixteen days.

Which of the three operations shall be performed in such a case? Frank states that his operation is devised for carcinomatous strictures only. It would require a troublesome operation to close the resulting fistula. Von Hacker's and Witzel's methods thus only come up for discussion.

With reference to the absolute patency of the fistula resulting from Witzel's procedure, we shall not fail by always giving it the preference, provided it can be carried out. Contra-indications are, according to Von Noorden:[1] 1. Great weakness of the patient, which would forbid an operation of nearly half an hour's time. This objection would not hold good any longer if we accept "early gastrostomy" in severe burns of the œsophagus. 2. If, on account of cicatricial tissue in the gastric wall, the two folds of the latter cannot be properly raised. This objection also falls to the ground if gastrostomy be done shortly after the accident. 3. If the stomach wall does not yield to traction. Witzel asserts that "even the very much contracted stomach" can be pulled forward in front of the abdominal wound by a steady pull continued for a short while. I can corroborate this by my own experience. The future must decide as to this point. 4. The small size of the stomach in young children.

In cases of this kind, then, we would resort to Von Hacker's method. If the points in question cannot be decided before, but are found during the operation, we will close the oblique peritoneal wound and add at once Von Hacker's incision. In children the rectus muscle is rather poorly developed. Its sphincter-like contraction will rarely prevent leakage. Then we would be in need of the Von Hacker-Scheimpflug canula or Mikulicz's glass tampon (*loc. cit.*). Another drawback of Von Hacker's operation which has to be taken into account is that it will rarely close spontaneously after removal of the tube.

This spontaneous healing of the gastric fistula, as observed by Mikulicz, is certainly one of the most brilliant points in favor of Witzel's operation in this class of cases.

2. *Malignant stenosis.* Further experience is needed with reference to the merits and possible drawbacks in the final result of the Ssabanejew-Frank method before an attempt can be ventured at giving to each of the three operations its proper place. Yet the following may with propriety be said now. If further observation corroborates the experience made by Ssabanejew, Frank, and myself, namely, that after this method in every case perfect patency of the fistula also results, as after Witzel's,

[1] Loc. cit.

I do not doubt that it will become the standard operation for gastrostomy in cases of malignant œsophageal stenosis, and for these reasons: The operation can be more rapidly done than Witzel's; it is also safer, because the stomach is not incised primarily, but after the peritoneal cavity is closed; the stomach is, as in Witzel's operation, opened at once in the same sitting; a wide fistula results, which easily admits the largest-sized tube or nozzle of a syringe; the tube can be left out with safety; contraction cannot occur; thus the patient will be very comfortable and can himself easily introduce the tube whenever a meal is due.[1]

If further experience should be adverse, however, which seems rather improbable, we again must elect between Von Hacker's and Witzel's operations only. About the same would hold good here that has been said above with reference to the cicatricial stenosis. If the patient be not too low, if the stomach wall can be drawn up and folded, Witzel's method will deserve preference in every case. But a large-sized tube should be selected for being infolded. Von Hacker's method will thus be reserved for those patients who are very low (cocaine anæsthesia).

It is to be hoped that, in view of these excellent operations, cases of malignant stenosis of the œsophagus will be nowadays referred to the surgeon in the early and not any longer in the last stage of the disease. "As soon as fluids and semi-solid food find some resistance in passing down, or as soon as the patient is visibly losing ground," says Mikulicz, "gastrostomy is indicated." I should make an addition to this dictum, and say, "and as soon as the scales show a steady, though perhaps slow decrease in the patient's weight." For this reason such patients should be ordered to weigh themselves every week or fourteen days and report to the physician. "It is absolutely wrong to let gastrostomy be the very last resort. By such temporizing, a condition of inanition will be produced in the patient which would contra-indicate an interference that otherwise has very little risk, if any. The surgeon cannot dare to do anything with the patient in a far-advanced state of inanition. The physician should be cognizant of the fact that a certain degree of strength and resistance is needed to stand even a relatively small operation; that a certain degree of active work of the tissues of the organs and of the whole organism is required to heal even a small wound; and that, lastly, the faculty of digestion and assimilation in the gastro-intestinal tract ceases in a certain stage of inanition, and cannot be awakened, even when a gastric fistula has been established. The patients starve to death with a full stomach, with full intestines." (Von Noorden.)

[1] It may occur that the stomach wall will not yield enough to be drawn out in a cone; perhaps then, if the carcinoma involves the lower portion of the œsophagus and the cardia or a part of the gastric wall—if this be the case, Witzel's operation should be resorted to.

An early operation, on the other hand, will be less dangerous; it can be done under general anæsthesia; it will by its result, "the rapid improvement of the patient's general condition," enable the doctor to more easily conceal from the patient the real nature of his trouble;[1] it will spare the patient the continuously increasing difficulty in swallowing; it will prevent dangerous and useless attempts at dilatation; and it will prolong life on account of the slower growth of the tumor due to the elimination of the mechanical and chemical irritation produced by the passage of food. This point deserves to be especially emphasized; with reference to it, gastrostomy for carcinoma œsophagi must be put in parallel with colostomy for carcinoma recti. The latter gives less trouble, grows slower, and breaks down less rapidly, if excluded from the intestinal tract; the same holds good for carcinoma œsophagi.

Summing up, I would say:

1. There are now three useful and reliable methods of gastrostomy at the surgeon's disposal. Of these, one (Witzel's) prevents leakage with absolute certainty. The two others, if properly carried out, promise the same good result. Thus the patient who had been submitted to this operation will not starve from regurgitation of the food alongside the tube.

2. In view of this fact, gastrostomy should be resorted to "early" in cases that will sooner or later need this operation.

3. In cases of burn of the œsophagus, primary gastrostomy and timely dilatation of the contracting scar will most probably prevent conditions which at present generally confront the surgeon in this class of cases, and are sometimes incurable. Witzel's method of gastrostomy deserves preference. The oblique canal produced by it will close spontaneously when the tube has been removed. Thus a secondary operation will not be needed.

4. In cases of cancer of the œsophagus a gastric fistula should be established as soon as the scales show a steady decrease of the patient's weight.

5. Further experience is needed with reference to Ssabanejew-Frank's method before an attempt can be made at giving each of the three operations its proper place in the treatment of cancerous stenosis. If future observations be favorable, Ssabanejew-Frank's operation seems to be destined to become the standard one for malignant stricture of the œsophagus. If unfavorable, Witzel's method should be done wherever it can be carried out.

6. Von Hacker's method should then be reserved for far-gone cases, and should, if the patient be very weak, be done under cocaine-anæsthesia, best at two sittings. If properly performed the outlook for making the fistula close tightly around the tube is good.

[1] And this so much oftener, as it has been frequently observed, also—as in almost every one of my cases—that patients with cancerous tight stricture of the œsophagus can swallow again, for a time at least, shortly after they have been fed through the gastric fistula only.

BACTERIOLOGICAL INVESTIGATIONS OF DIPHTHERIA IN THE UNITED STATES.

A Report in Behalf of the American Committee on Diphtheria[1] to the Eighth International Congress of Hygiene and Demography, held in Budapest, September 1 to 9, 1894.

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It is intended in this report to present the more important results of the bacteriological study of diphtheria by American investigators, so far as these results are believed to be of interest for the purposes of this Congress.

The most extensive bacteriological researches on diphtheria in this country have been made by Prudden and Park in the Pathological and Bacteriological Laboratories of the College of Physicians and Surgeons, Columbia College, New York (Director, Dr. T. M. Prudden), and by Park (partly in co-operation with Beebe) under the Division of Pathology, Bacteriology, and Disinfection, Health Department of New York (chief of this Division, Dr. Hermann M. Biggs); by Welch, Abbott, Booker, and Flexner in the Pathological Laboratory of the Johns Hopkins University and Hospital (Director, Dr. W. H. Welch); by Koplik, working in the Carnegie Laboratory, Bellevue Hospital Medical College (under the direction of Dr. E. K. Dunham); by Abbott, Ghriskey and Ravenel in the Laboratory of Hygiene, University of Pennsylvania (under the direction of Drs. J. S. Billings and A. C. Abbott); by Councilman, Williams, Morse, Townsend, Wright and Emerson in Boston, chiefly in the Boston City Hospital, and in the Pathological Laboratory of the Harvard Medical School (Director, Dr. W. T. Councilman). The references to articles are given at the end of this paper.

The writer is indebted for original abstracts of their work (some of it hitherto unpublished) and their preparation for this report, to Drs. Prudden, Park, Koplik, Abbott, Ravenel, Booker, Morse, Wright, and Emerson; and he desires to express to these gentlemen his cordial thanks for their kind co-operation, and also to Dr. Councilman for procuring the abstracts of work done under his supervision. It was intended at first to publish *seriatim* these abstracts, but it is believed that a systematic presentation of the combined results under suitable headings will be more useful. The purposes and limits of this report permit the statement of only some

[1] This committee, of which Dr. John S. Billings is Chairman, was appointed by the Secretary General of the Eighth International Congress of Hygiene and Demography, together with similar committees in other countries, to report to the Congress upon various questions relating to diphtheria. To the writer was assigned the subject of this report.

of the results of American workers, and these often in much abbreviated form. The writer, whose part is only that of a referee, will make free use, often without further acknowledgment, of the words of the authors. The larger part of the investigations of Park reported in this paper are unpublished. This report embraces the results up to May, 1894.

In accordance with the programme of the Congress, especial attention will be given in this report to the results thus far obtained in the United States as to the following points:

The application and value of bacteriological methods in the diagnosis of diphtheria; the proportion of cases of pseudo-membranous inflammations of the throat and air-passages due to the Loeffler bacillus; the various localizations of the diphtheria bacillus; atypical forms of diphtheria, and false diphtheria; the persistence of the Loeffler bacillus in the throat after recovery from diphtheria; the occurrence of this bacillus outside of persons affected with diphtheria; the characters of pseudo-diphtheria bacilli.

Historical.—The first bacteriological study of pseudo-membranous inflammations of the throat by modern methods in this country was by Prudden in 1889. He studied by microscopical examination and cultures twenty-four cases diagnosticated as diphtheria in young children, most of them in New York hospitals in which the affection had assumed the character of an epidemic. In a few of these cases the pseudo-membranous inflammation occurred by itself, but in most of them it was associated with scarlatina, measles, or suppuration. In all but two of these cases he found a streptococcus, usually in large numbers in the local lesions and in small numbers in a few cases in the viscera. Loeffler's bacillus was not found in any of this group of cases.

Prudden has withdrawn the name streptococcus diphtheriæ, originally applied by him to the streptococcus found in these cases, which did not appear to differ from the streptococcus pyogenes. It is clear that the group of cases first studied by Prudden were not cases of genuine diphtheria, but were for the most part cases of secondary pseudo-membranous inflammations, which are now known to be oftener due to a streptococcus than to the Loeffler bacillus.

In February and March, 1891, Welch and Abbott published the results of the bacteriological examination of eight cases of primary diphtheria, in all of which the Loeffler bacillus was found.

In April, 1891, Prudden published the results in twelve cases of diphtheria unassociated with complicating lesions, and found the bacillus of Loeffler in all but one.

Since these first publications the number of cases of suspected or established diphtheria which have been examined bacteriologically in the United States, so as to be available for statistical analysis, has been between 6000 and 7000 (May, 1894).

Several hundred of these cases were examined in hospitals, dispensaries, and private practice, but by far the larger number were examined under the Health Department of the City of New York. Under the intelligent and efficient direction of Dr. Biggs the Health Department has entered upon an undertaking which, upon such a scale, is believed to be hitherto unparalleled, to wit: the systematic examination of all cases of suspected diphtheria (unless objection is made by the attending physician or except certain cases in which it is not deemed advisable to disturb the patient) occurring in New York—the study of the cultures thus obtained being made by Dr. William H. Park and Mr. Alfred Beebe, who are thoroughly trained and careful bacteriologists. Some of the results of this undertaking will be considered in this paper.

All the bacteriological aspects of diphtheria and other pseudo-membranous inflammations of the throat, with the exception of systematic study of immunization and serum-therapy, have been investigated by the various American workers already mentioned. Attention, however, will not be given in this paper to the purely morphological and cultural characters of the diphtheria bacillus, except as they relate to the question of differentiation of the pseudo-diphtheria bacillus.

TECHNIQUE.—In general the methods of examination have been those usually employed, and only a few points need to be especially mentioned.

To obtain the material for cover-slips and culture from the suspected throat, Park uses sterile cotton swabs made by wrapping firmly a small pledget of absorbent cotton around the roughened end of a thin, stiff steel rod six inches in length. These swabs placed in an equal number of glass tubes, plugged with cotton, are sterilized for one hour by dry heat at 150° C. A similar method is employed by Councilman and others in Boston. Koplik prefers, both to the cotton swab and to the ordinary platinum wire, especially for removing tonsillar plugs, a small sterilized thin scoop in the form of a long bent probe.

All are agreed as to the superiority of Loeffler's blood-serum mixture for making original cultures from the throat. The blood-serum mixture is now generally prepared by direct sterilization and solidification in the steam or hot-air sterilizer at a temperature a little below 100° C., instead of the old method of fractional sterilization at a lower temperature. The loss of transparency in the medium is compensated by the greater facility in preparation, and no difficulty is found in seeing the colonies after twelve to eighteen hours. Egg-albumen, as recommended by Johnston, and urine agar were found by Park less satisfactory than blood-serum.

While recognizing that the bacillus of diphtheria grows well on agar when planted from cultures on blood-serum or other media, and that the agar colonies are the most characteristic and best adapted for micro-

scopical study, Park calls attention to the uncertainty of glycerin-agar as a medium for making original cultures from the exudate. This uncertainty is due not only to unavoidable variations in the composition of the beef-broth, and to the less luxuriant character of the growth of the bacillus diphtheriæ as compared with its coincident growth with other bacteria upon blood-serum, but also to the observation that when the bacilli diphtheriæ are few in number or have been affected by previous application of antiseptics, they may fail to grow upon agar when blood-serum inoculated at the same time and with the same exudate presents growth of the bacilli. Of course, the use of antiseptics shortly before making the inoculation of the tube is likely to render the cultures useless.

When it is desired to determine accurately the kinds of bacteria associated in the exudate with the diphtheria bacillus, especially the presence of streptococci, it is desirable not to rely upon blood-serum alone, but to make also agar plates from the exudate.

In testing the virulence of diphtheria cultures emphasis is laid, in all of the later work, upon observing precautions which have been noted especially by Behring and by Escherich. Thus Koplik selects young guinea-pigs weighing from 350 to 450 grammes, and injects 0.1 to 0.5 cc. of a bouillon culture forty-eight hours old in the thermostat. The quantity injected should be taken from the full culture after shaking and not after pouring off the supernatant fluid from the deposit. Park also emphasizes the importance of selecting, if possible, young guinea-pigs and injecting $\frac{1}{4}$ to $\frac{1}{2}$ per cent., in special cases even 1 per cent., of the body-weight of a forty-eight hour bouillon culture grown at 37° C.

For ordinary diagnostic purposes cover-slip preparations and cultures are considered sufficient without awaiting the result of the animal experiment. In all of the cases both cover slip preparations and cultures were made, and in many also inoculation of guinea-pigs.

Methods Adopted by the Health Department in New York.—Under the Division of Pathology, Bacteriology, and Disinfection, of which the Director of the Bacteriological Laboratory is Dr. Hermann M. Biggs, and the Inspector of Diphtheria Dr. William H. Park, the Health Department of New York has organized a system which renders available to physicians throughout the city the bacteriological diagnosis of diphtheria, and which utilizes in the interests of preventive medicine the important discoveries relating to the causation and mode of spread of diphtheria. These efforts have met, for the most part, with hearty co-operation on the part of physicians.

For carrying out this and similar work, a bacteriological laboratory has been equipped and competent bacteriologists and a force of physicians as inspectors are employed. Cultures are made, not only when

specifically requested by physicians, but also when no objection is raised by the attending physicians, diphtheria being, of course, a notifiable disease. Especial attention is given to examinations in boarding-houses, hotels, and tenement-houses.

In general, cultures are not made for diagnosis from secondary cases in families where the first case was proven bacteriologically to be diphtheria, or in cases of croup in which tracheotomy or intubation has been performed, the knowledge to be gained by cultures in such cases being too slight to compensate for the disturbance of the patient. All such cases, and, in fact, all suspected cases in which cultures are not obtained, are regarded as diphtheria. Later cultures are, however, made to determine when the bacilli have disappeared and the premises are ready for disinfection.

Indeed, especial importance is attached to these later cultures, for in view of an extensive research to determine the length of time during which diphtheria bacilli may persist in the throat, the Health Department has adopted the rule, "That no person who has suffered from diphtheria shall be considered free from contagion until it has been shown by bacteriological examination, made after the disappearance of the membrane from the throat, that the throat secretions no longer contain the diphtheria bacilli, and that until such examinations have shown such absence all cases in boarding-houses, hotels, and tenement-houses must remain isolated and under observation. Disinfection of the premises, therefore, will not be performed by the department until examination has shown the absence of the organisms." Cultures are made also from the apparently healthy throats in an infected household for reasons which will appear later in this report.

The culture-tubes may be inoculated by the attending physician, if he so desires; otherwise the cultures are made by the inspector of the district in which the case occurs. The outfits for making the cultures, consisting of a box containing a tube of blood-serum and a sterilized swab in a test-tube, are distributed to about forty stations at convenient points throughout the city, these being mostly druggist shops. A list of these stations is published, at which physicians can obtain the outfit free of cost.

Printed directions for making the cultures in suspected cases of diphtheria are supplied with the outfit, and are as follows:

"The patient should be placed in a good light, and, if a child, properly held. In cases where it is possible to get a good view of the throat, depress the tongue and rub the cotton swab gently, but freely, against any visible exudate.

"In other cases, including those in which the exudate is confined to the larynx, avoiding the tongue, pass the swab far back, and rub it freely against the mucous membrane of the pharynx and tonsils. Without

laying the swab down, withdraw the cotton plug from the culture-tube, insert the swab, and rub that portion of it which has touched the exudate gently but thoroughly all over the surface of the blood-serum. Do not push the swab into the blood-serum, nor break the surface in any way. Then replace the swab in its own tube, plug both tubes, put them in the box, and return the culture outfit at once to the station from which it was obtained.

"A report will be forwarded the following morning by mail, or can be obtained by telephone, after 12 noon."

There follows a list of the stations from which the culture-outfits can be obtained free of cost.

The inoculated tubes and swabs are sent from the stations to collecting depots, whence they are taken by the collectors on the same day to the laboratory. There is filled out and returned with the cultures a printed form giving the name and address of the attending physician and of the maker of the culture, the date, the name, age, and address of the patient, the clinical diagnosis, various details relating to the supposed causation, the duration and character of the disease, the use of antiseptic applications, and a statement as to whether the inoculation was satisfactory. Another printed form is to be filled out for later cultures.

From time to time explanatory circulars as to the character and results of the work and the rules adopted by the department are issued to physicians.

There are printed forms to be filled out in reporting to physicians the results of the cultures; one form is for cases in which diphtheria bacilli are found; another is for cases in which the bacilli once present have disappeared, and on this is the statement that the case is ready for disinfection, if other circumstances allow; a third form is for cases in which the cultures do not show the presence of diphtheria bacilli; and a fourth in the case of cultures which do not permit an exact bacteriological diagnosis with a statement of reasons for the failure, and, if need be, another culture is requested.

Specimens of these various printed forms accompany this paper for the inspection of those attending the Congress.

The results thus far obtained by this system have been satisfactory. From May 4, 1893, to May 4, 1894, 5611 cases of suspected diphtheria were subjected to bacteriological examination, some of the results of which will be stated later in this report.

As to the reliance to be placed upon a culture in making a diagnosis, Park states, as the result of the very large experience accumulated by the Health Department, "The examination by a competent bacteriologist of the bacterial growth in a blood-serum tube which has been properly inoculated and kept for fourteen hours at the body temperature can be thoroughly relied upon in cases where there is visible membrane in the

throat, if the culture is made during the period in which the membrane is forming, and no antiseptic, especially no mercurial solution, has lately been applied. In cases in which the disease is confined to the larynx or bronchi, surprisingly accurate results can be obtained from culture, but in a certain proportion of cases no diphtheria bacilli will be found in the first culture, and yet will be abundantly present in later cultures. We believe, therefore, that absolute reliance for a diagnosis cannot be placed upon a single culture from the pharynx in purely laryngeal cases. The apparent mistakes, however, have been few. Cultures cannot be certainly relied upon after the membrane begins to disappear."

The great majority of physicians desire cultures to be made and appreciate the value of an accurate diagnosis. Cases which are proved not to be diphtheria are not required to be isolated and are not kept under supervision by the Department; until such proof, however, suspicious cases are treated as diphtheria.

The duration of the period of isolation and the time for disinfection are determined by the bacteriological examination in accordance with the rule already quoted. The increased value of statistics as to the distribution, prevalence, mode of spread, clinical characters, mortality, and treatment of diphtheria when the diagnosis is based upon a bacteriological examination, requires no especial emphasis. Some of the scientific results which have been obtained by Dr. Park and Mr. Beebe from this immense material will be mentioned later in this article.

Proportion of Cases of Suspected Diphtheria Proved by Bacteriological Examination to be True Diphtheria.—There are several points to be considered in estimating the value of statistics upon this point. The character of the cases selected for examination, whether wholly characteristic or less characteristic of diphtheria, will be of decisive influence. The degree of suspicion in a given case may be very slight, or one physician may consider the case highly suspicious or certain, and another may regard it as very doubtful or certainly not diphtheria.

It is particularly in the doubtful cases that a bacteriological examination is desired and is of the most importance. Diphtheria may occur without any false membrane and as an angina or tonsillitis of very mild character.

In statistics based upon the statements of a large number of physicians as to the character of a local exudate it doubtless may happen that simple pultaceous and purulent exudates may be mistaken for genuine fibrinous exudates. The inclusion of cases of pseudo-membranous angina, occurring in scarlet fever or other diseases, or even during the prevalence of scarlet fever, will influence the statistical result. Special local conditions, such as the selection of cases exclusively from children's hospitals, and probably the time of year, may likewise have

an influence upon the result. The care with which the cultures and cover-slip preparations are made and examined, the period of the disease at which they are made, the previous local application of antiseptics, are factors which will influence the result.

These considerations (and still others might be mentioned) may render the statistics of different observers not strictly comparable, and they indicate that some statistics are likely to be more accurate and valuable than others.

We owe to Park and to Morse the most extensive statistics as to the subject now under consideration. In his first published series Park examined 140 pseudo-membranous cases uncomplicated with scarlet fever, in which the clinical diagnosis of probable diphtheria had been made. He found the Loeffler bacillus in 54 cases (39 per cent.). Of the 86 remaining cases the membrane was confined to the tonsils in 58, and these latter were all mild.

In his second published series, 104 uncomplicated cases were examined and the Loeffler bacillus was found in 73 (70 per cent.). Dr. Park has kindly furnished the writer his later, as yet unpublished, statistics (partly in co-operation with Beebe), which will be included in a report to the Board of Health of New York. In this third series, 5611 cases of suspected diphtheria occurring in New York during the year ending May 4, 1894, were examined bacteriologically. A few of these cases complicated scarlet fever, but the precise number of such cases is not stated. The Loeffler bacillus was found in 3255 cases (58 per cent.), and was absent in 1540 cases (27 per cent.). In 816 cases, although no diphtheria bacilli were found in the cultures, yet either because the cultures were made after the fourth day of the disease, or because the exudate was imperfectly obtained from the throat, or because the culture media had become contaminated or were too dry, the cases were considered to be of a doubtful nature as far as the bacteriological examination was concerned. If the doubtful cases be thrown out, which, however, it is hardly fair to do, as most of them are considered by Park not to have been diphtheria, we have, in 4795 cases of suspected diphtheria, about 68 per cent. of cases of true diphtheria, and 32 per cent. which were not diphtheria.

Morse found, in 301 cases without scarlet fever admitted to the diphtheria ward of the Boston City Hospital, the Loeffler bacillus in 217 (72 per cent.).

If we add all of the cases of suspected diphtheria in Park's and Morse's statistics we have 6156 cases, of which 3599, or 58.5 per cent., were proved bacteriologically to be true diphtheria. If we reject from Park's third series the cases in which the bacteriological examination was unsatisfactory we have 5340 cases, of which 67.5 per cent. were cases of true diphtheria.

Park's first series was remarkable on account of the small percentage of cases of true diphtheria. The examinations were made in February and March, and scarlet fever was very prevalent, diphtheria less so. His experience at this time he considers to have been exceptional, and it has not been repeated. His own conclusion is, from his later observations, that about 60 per cent. of the cases of suspected diphtheria in New York are true, and about 40 per cent. are false, diphtheria.

We are, of course, not to infer that only 60 per cent. of the cases which are considered by physicians to be undoubted diphtheria are really diphtheria, but that this is about the percentage of cases of genuine diphtheria in the pseudo-membranous inflammations of the throat in which there is more or less suspicion of diphtheria.

Upon each blank sent with a culture-tube by the Health Department of New York, a space is left for the voluntary recording of the clinical diagnosis by the physician. In 1210 cases of true diphtheria the physician's diagnosis was recorded. In 1011 the case was considered on clinical grounds to be diphtheria, in 102 to be doubtful, and in 87 to be probably false diphtheria. In 675 cases in which the diphtheria bacilli were absent a diagnosis of diphtheria was made in 50, the rest being all considered to be in doubt.

In this connection Park says: "The cases which present the characteristic appearances of well-developed diphtheria regularly contain in the pseudo-membranes abundant diphtheria bacilli. It is the slightly developed cases in which a culture is most needed. Here without cultures we need to go more by the history of exposure than the appearance of the case. In a family where an undoubted case of diphtheria existed, any form of sore throat, with or without exudate, in a child or adult, would be probably a case of diphtheria, while a similar-appearing tonsillitis or pharyngitis in a person who had not been exposed to diphtheria would be, in all probability, a case of ordinary non-diphtheritic throat inflammation." In only about one-half of the cases of diphtheria examined by the Health Department of New York did careful inquiry reveal any connection with other diphtheria cases.

The statistics which have been cited are based upon the examination of pseudo-membranous inflammations of the throat and air-passages mostly uncomplicated with scarlet fever.

Of particular significance is the outcome of Morse's study: that in no less than 28 per cent. of the cases admitted to the diphtheria ward of the Boston City Hospital, diphtheria bacilli were not found.

Membranous Croup.—Welch and Abbott, Booker, Williams, and others have reported cases of diphtheria in which the pseudo-membrane was confined to the larynx and lower air-passages. In Park's statistics there are 286 cases (283 children and 3 adults) in which the membrane was entirely or chiefly confined to the larynx or bronchi. In the cultures

from 229 of these the Loeffler bacillus was found, and 167 of these 229 cases showed no pseudo-membrane or exudate above the larynx, while in the remaining 62, although the larynx was mainly involved, there was also some membrane or exudate present on the tonsils or pharynx. In the remaining 57 no diphtheria bacilli were found, but of these, the cultures in 17 were unsatisfactory, leaving the bacteriological diagnosis doubtful. In the 40 cases in which the diphtheria bacilli were absent the disease was confined to the larynx or bronchi in 27, while more or less exudate or membrane was present on the tonsils or pharynx in 13. Of the cases of membranous croup in New York, therefore, at least 80 per cent. are diphtheria and only 14 per cent. were undoubtedly not diphtheritic. Cases of membranous croup were observed to be the origin of cases of characteristic pharyngeal diphtheria.

The comparatively small number of laryngeal cases examined is accounted for by the custom of the department inspectors not to make cultures in cases which have been intubated or which seem so sick that the family might think injury had been done by inserting the swab.

In a personal communication Dr. Park writes that he has no doubt as to the occurrence of non-diphtheritic pseudo-membranous laryngitis. He speaks of two cases in which the microscopical examinations and cultures made both during life and after death showed no diphtheria bacilli, but streptococci were present. Booker has reported such a case complicating measles.

Fibrinous Rhinitis; Nasal Diphtheria.—Park reports 10 cases of fibrinous rhinitis in all of which the Loeffler bacillus was found. All were typical and of the usual benign character. In 9 the membrane was confined to the nose, and in one there was also slight fibrinous exudate on the tonsils. Only the 6 cases in his first series are reported in detail. In 4 the Loeffler bacillus was associated with streptococci and in 2 with staphylococci. The virulence of the diphtheria bacillus was tested in 5 cases. The bacillus from one case killed a guinea-pig in four days; those from two cases in five days, and those from two other cases rendered the guinea-pig sick, but the animals eventually recovered. In addition to this weakening of virulence Park found that the bacilli from the first six cases grew more feebly than usual both on blood-serum and agar, and died out in cultures sooner than usual.

Abbott has published 3 cases of fibrinous rhinitis, and Ravenel, working under Abbott's direction, has kindly sent me an account of 2 additional cases which he will publish. All of these 5 cases were of benign character, the membrane being confined to the nasal cavity. Two were in sisters in the same family. In all the Loeffler bacillus was present in the membrane; in 3 it was of the customary virulence, and in 2 it produced only local reaction, in large doses failing to kill even half-grown guinea-pigs.

Townsend observed in 14 cases of diphtheria, mostly of mild character, occurring in the Children's Hospital in Boston, 7 cases in which the nose was affected. Of the latter, in 5 cases the disease was primarily nasal, the membrane being confined to the nose in 4. These 4 cases of primary and exclusively nasal diphtheria were mild. In all the Loeffler bacillus of customary virulence was found. He emphasizes the case with which these primary nasal cases may be overlooked if the membrane remains confined to the nose, the importance of a bacteriological examination in all suspicious cases of nasal discharge, the mild character of many of the cases, their resemblance by superficial examination in some cases to an ordinary coryza, and the danger of such cases as sources of infection.

Park mentions an instance in which a child with only a slight nasal discharge, in which Loeffler bacilli were demonstrated, gave rise to diphtheria in four children, of whom two died. The first child came from a family in which there had been a case of diphtheria three weeks before.

Clinically Atypical Diphtheria.—The most important bacteriological study of this subject has been made by Koplik, who has kindly furnished the following abstract of his work:

The writer has for the past three years directed his attention chiefly to the study of those forms of diphtheria which clinically do not present any of the classical local symptoms of the disease. The direct outcome of these studies has been to demonstrate how multiform diphtheria may be, from a clinical standpoint, in its various local manifestations. The first series of studies was published in the *New York Medical Journal*, August 27, 1892, and *Archives of Pædiatrics*, September, 1892. In these papers the writer gave the results of studies of the following forms of diphtheria:

A. Cases in which there is from the onset and through the whole course of the disease no local manifestation of membrane, either *diffuse* or *punctate*. These cases may be so exceedingly mild in their course as to simulate a simple catarrhal angina, or they may be accompanied not only by anginal symptoms, but laryngeal symptoms, such as croupy cough and croupy breathing. In the latter case, early in the disease, we find upon the most careful inspection of the fauces no signs of membrane; later, this picture may persist, or there may appear punctate areas of membrane upon the tonsils or pillars of the fauces. The point of greatest moment, however, is that at first and for days the closest inspection of the fauces and epiglottis reveals no signs of membrane. The croupy cough and breathing reveals involvement of the larnyx. Where only the cough is manifest it is to be presumed that in the larynx the condition is much like that found in the throat, an intense inflammation without membrane.

It is, of course, impossible to establish the exact anatomical conditions. In these cases I have fixed the diagnosis of diphtheria by scrapings from the tonsil and fauces. The most dangerous of these cases in spreading infection are those which present symptoms of a mild

catarrhal angina. The writer has published a series of cases occurring in the same family of children who presented these mild anginal symptoms. They communicated their anginal diphtheria to one another. Some of the cases developed membrane (punctate, in other cases diffuse of fauces and larynx), resulting in fatal laryngeal stenosis. On the other hand, the writer has published a series of cases of children who presented all symptoms of acute catarrhal angina, with signs of lacunar amygdalitis. In these cases the croupy crough and breathing were not present. These were not diphtheritic. The only test is the bacteriological one.

B. A class of cases in which the tonsils are covered by a pultaceous mass of exudate, and no consistent membrane. These cases may or may not be true diphtheria.

C. A large class of cases presenting punctate form of membrane; some of these spots of membrane may be isolated and minute on the tonsil; in some forms the specks of membrane are depressed in the surface of the tonsil. In other forms minute or larger ulcerations exist. These cases may be diphtheritic, and in the vast majority of cases are true diphtheria. In other cases we fail to find the Loeffler bacillus.

D. The most important class of clinically atypical diphtherias are those cases which begin or even run their entire course with the clinical local picture of a typical lacunar or follicular amygdalitis. In my last paper, entitled "Acute Lacunar Diphtheria of the Tonsils" (*New York Medical Journal*, March 10, 1894) these cases are divided into groups. In the first group of cases the course of the disease is that of an exceedingly mild lacunar or follicular amygdalitis. The fauces are injected, the tonsils are enlarged, there is an indication here and there of a lacuna, by a yellow spot; the lymph-glands at the angle of the jaw may or may not be enlarged; the constitutional symptoms are almost *nil*. Extraction of the contents of the lacunæ or follicles shows the presence of the bacillus diphtheriæ.

In the second group of cases the tonsils are more inflamed, the lacunar plugs protrude from the tonsils in the form of soft fibrinous masses; the patients seem quite ill, as if suffering from a severe amygdalitis. In these cases also the lacunar plugs are found to contain the Klebs-Loeffler bacillus in almost pure culture. Here also glandular nodes are found at the angle of the jaw. The course of these cases clinically is interesting; some never develop membrane as a mass on the tonsils; others after the third day develop distinct thick confluent membrane on the tonsils. Others remain lacunar in the local tonsillar picture, but develop laryngeal diphtheria, with croupy cough and breathing. In this class the lymph nodes at the angle of the jaw may be much enlarged in packets, or not much above what is found in ordinary anginas. These cases may give rise to other cases in the same family in which the course of the disease is that of a simple lacunar amygdalitis, but which upon examination prove to be true diphtheria.

The third group of cases are those in which the disease begins with the picture of severe lacunar amygdalitis, but the prostration of the patient is exceedingly great; the temperature may be low. There is great glandular swelling at the angle of the jaw. After a few days the prostration is much greater; there appears nasal discharge, and small shreds of membrane are discharged from between the much swollen tonsils. The tonsils themselves are now covered with one continuous

membrane, but here and there shreds are seen on the surface of the eroded tonsil. These cases are the septic lacunar diphtherias with nasal symptoms, and give a bad prognosis.

In a series of 39 cases of acute lacunar or follicular inflammation of the tonsils, 12 were proven to contain the Loeffler bacilli in the depths of the tonsillar lacunæ. Thus, fully one-third of the cases were diphtheria. It is not intended to draw any percentage conclusion from this, but it demonstrates how insidious an affection lacunar amygdalitis may be. (*New York Medical Journal*, March 10, 1894.)

Diphtheria sine membrana has been observed also by several other American investigators. Reference has already been made to Park's statement that any form of sore-throat in a person exposed to diphtheria is likely to be referable to the diphtheria bacillus. He says: "Under diphtheria should be included all inflammations of mucous membranes due to the diphtheria bacillus of Loeffler. A case with an acute hyperæmia of the mucous membrane in which the Loeffler bacilli are present is considered as truly a diphtheria as one with pseudo-membrane or exudate." Only the bacteriological examination can determine the true character of these cases. It is to be borne in mind, as pointed out by Councilman, that the absence of the pseudo-membrane in the places where it is ordinarily found is not proof that it is not present elsewhere, perhaps in some place not accessible to examination.

Other Localizations of the Diphtheria Bacillus and its Distribution at Autopsies.—Councilman has found the diphtheria bacillus in one case of otitis media following diphtheria and in two cases of otitis media, without affection of the throat, in measles. Townsend observed a case in which an old tracheotomy wound was attacked and the disease spread to the bronchi, proving rapidly fatal, with demonstration of the Loeffler bacillus. Park found diphtheria bacilli in two cases in wounds of the finger received by physicians in intubating children with diphtheria. In one case the bacilli persisted in the wound for six weeks. Wright (unpublished results communicated to the writer) has demonstrated the presence of this bacillus in excoriated or ulcerated surfaces of the skin in 7 cases, in paronychia in 1, in mastoid abscess in 1, in purulent conjunctivitis in 1—all in cases of diphtheria. At autopsy he cultivated the bacillus from the ecchymotic mucous membrane of the stomach in 2 cases, and from œdematous tissue behind the œsophagus in 1. Wright also reports that in 10 out of 14 autopsies in cases of diphtheria broncho-pneumonia was present, and that in 9 cases the Loeffler bacillus was found in the lung, and in the remaining case only the streptococcus. In 7 of the 9 pneumonias streptococci accompanied the Loeffler bacillus, as well as in two other lungs in which no pneumonia existed. In 3 or 4 pneumonias the diplococcus pneumoniæ was also present. The staphylococcus pyogenes aureus was also met in 4 pneumonias, once with the Loeffler bacillus and three times in company

with all of the three bacteria just mentioned. Flexner has found the Loeffler bacillus in two broncho-pneumonias complicating diphtheria, and by microscopical examination of sections demonstrated Loeffler bacilli, mostly within leucocytes, in the broncho-pneumonic exudate. In both cases the diplococcus pneumoniæ was, however, the predominant organism.

Howard has reported a case of acute ulcerative endocarditis (without diphtheria) with infarctions in the spleen and kidneys, in which, both by cultures and microscopical examination, bacilli indistinguishable morphologically and in cultures from the diphtheria bacillus, but devoid of virulence, were found abundantly and in pure culture in the valvular vegetations, the spleen, and the kidneys.

As to the presence of the diphtheria bacillus in internal organs at autopsy Booker reports a case of diphtheritic laryngitis in which at autopsy Loeffler bacilli were found in the blood, spleen, and lungs. Wright has found this bacillus out of 14 cases dead of diphtheria in the lung in 13 cases (9 with broncho-pneumonia), in the liver in 3, in the spleen in 2, in the cervical or bronchial lymph-glands in 5, in the kidney in 1, in the blood in 1, and in the mesenteric lymph-glands in 2. In 7 of these cases there was streptococcus septicæmia and in 2 a similar poly-infection with the staphylococcus pyogenes aureus. Two of the autopsies showed no marked lesions of diphtheria in the throat or trachea, the nasal cavities not having been examined. Both yielded virulent Loeffler bacilli—in one from the cervical lymph-glands and in the other from the pharynx. In both the bacillus was found in the air-passages. The bacillus, with slight virulence, was found also in certain of the organs in 3 autopsies on cases apparently not dead of diphtheria.

In guinea-pigs dead of experimental diphtheria, Wright found the diphtheria bacillus in the liver in 19 out of 155 cases, in the spleen in 15 out of 152 cases, in the heart's blood in 7 out of 153 cases, and in the kidney in 4 out of 151 cases.

Both in these as well as in the human cases the bacilli were found in the organs in but very small numbers, as a rule.

In three guinea-pigs the bacillus has been recovered by Wright from the seat of inoculation thirty-one to thirty-eight days after the date of inoculation.

Abbott and Ghriskey have observed frequently after inoculation of diphtheria bacilli into the testicles, less frequently after subcutaneous inoculation, of guinea-pigs, small nodules in the omentum composed mostly of polynuclear leucocytes and containing the bacilli in large number.

Welch and Flexner have described in detail the histological changes in experimental diphtheria, and have shown that these are characterized especially by widely distributed areas of cell death with nuclear frag-

mentation. They have demonstrated that the local fibrinous exudate may be caused by dead, as well as living, diphtheria bacilli, and that the other lesions are referable to toxic products of the bacillus.

Bacteria Associated with the Diphtheria Bacillus.—All of the investigators have found, as a rule, other bacteria associated with the Loeffler bacillus in the local exudates of diphtheria, although this bacillus is the only one which is constantly present. The most common associated micro-organism is the streptococcus pyogenes. Other bacteria which have been found are the regular buccal bacteria, the micrococcus lanceolatus, the staphylococcus albus and aureus, the bacillus coli communis (Morse), unnamed cocci and unnamed bacilli. Among these bacilli may be specified a short oval, slightly pointed bacillus, growing in long chains, running parallel to each, forming grayish-white colonies on agar not unlike those of the Loeffler bacillus. This bacillus was frequently encountered by Welch and Abbott. Morse describes a short, motile, liquefying bacillus and a non-motile diplo-bacillus growing invisibly on potato and not growing on gelatin. The only associated bacteria which are believed to exert pathogenic action are the streptococci, the pyogenic staphylococci, the micrococcus lanceolatus, and a coccus observed by Koplik which he considers to be identical with that described by Roux and Yersin and by Martin. Differences, mostly of a minor character, have been noted both in morphology and cultural characters between the different streptococci, but they are not considered sufficient to establish definitely different species.

It is regarded as established by all the investigators that the course and symptoms of diphtheria may be definitely influenced by these associated pathogenic bacteria, particularly by the most common of all, the streptococcus pyogenes. Cases of general streptococcus septicæmia accompanying diphtheria have been observed, especially by Councilman and his co-workers. Broncho-pneumonias, suppurations of lymph-glands and the so-called septic forms of diphtheria are attributed to these associated bacteria, especially to the streptococcus. It does not appear, however, either from the statistics of Park or of Morse, that the mortality is materially higher in cases of diphtheria in which the streptococcus is associated with the Loeffler bacillus than when the Loeffler bacillus is present without streptococci. In fact, the tables of Morse show a higher mortality when the Loeffler bacillus is associated with pathogenic staphylococci than with streptococci. Morse, however, does not attach decisive weight to this inference, as only in 25 cases did he attempt a thorough differential study of all associated bacteria. Such study will always show the presence of other bacteria. In these 25 cases he found the streptococcus in 19 cases (9 without other bacteria in culture, except the Loeffler bacillus, 6 with staphylococcus aureus or albus, or both), and staphylococcus aureus or albus in 10 cases (4 alone,

except the Loeffler bacillus). The general mortality in these 25 cases was 56 per cent., the mortality in the cases with the Loeffler bacillus and streptococci alone, 33 per cent., with Loeffler bacillus and staphylococci alone, 66 per cent., and with Loeffler bacillus, streptococci, and staphylococci, 66 per cent. As Morse says: "Statistics compiled from so small a number of cases are of little value." A similar conclusion as to the greater harmfulness of staphylococci than of streptococci is reached by Morse, contrary to the generally accepted opinion, also from the analysis of his larger table of 400 cases (301 without scarlet fever); but he admits that the comparatively small number of cases in which the streptococcus was found associated with the Loeffler bacillus (191 cases) may have been due to failure to recognize the minute, slow-growing colonies of streptococci in the twenty-four-hour blood-serum tubes, and the arrangement of the cocci on cover-glass specimens alone is not decisive as to the diagnosis of staphylococci, which were found in 295 cases. A minute and careful differentiation of the bacterial species was attempted by Morse in only 25 cases. We cannot, therefore, consider it established that staphylococci are more harmful than streptococci, especially as this inference is opposed to that of other investigators, and as Morse doubtless often overlooked the presence of streptococci.

Pseudo-Membranous Inflammations of the Throat in Scarlet Fever, Measles, and Typhoid Fever.—In an epidemic of scarlet fever in Baltimore at the time when the city was unusually free from diphtheria, one-half of the cases seen by Booker had pseudo-membranous affection of the throat. He has reported 11 cases of pseudo-membranous angina (2 fatal) complicating scarlet fever, and 1 case of similar angina without exanthem in a family three members of which had scarlatina. In all of these cases, as well as in 4 scarlatinal anginas without pseudo-membrane, Booker found streptococci as the predominant organisms, and in none was the Loeffler bacillus present. In one case croupous conjunctivitis due to streptococci was associated with the pseudo-membranous angina. The staphylococcus aureus was found in 11 cases without apparent influence on the severity of the case. No difference was observed between the early and the late pseudo-membranous anginas as regards the bacteria present. He attributes the absence of true diphtheria from so large a number of cases of scarlatina as due to the freedom of the city from diphtheria at the time. Booker describes with much detail the morphological and biological characters of the streptococci found, and divides them into groups, but these details will not here be considered.

Park in his first series of 159 cases reports 19 cases of pseudo-membranous inflammation of the throat complicating scarlatina. In 17 streptococci predominated, and in only 2 were Loeffler bacilli present,

these latter presenting diphtheritic laryngitis. Staphylococci were met in only a few cases.

The experience in Boston, as reported by Williams and by Morse, has been exceptional in the large proportion of cases of true diphtheria complicating scarlet fever. Of 97 cases of scarlet fever in the Boston City Hospital, of which 35 came from two homes for children, reported by Williams, membranous throats were present in 35. Of these 12 were due to the Loeffler bacillus, and in 23 the Loeffler bacillus was not found. In the 23 pseudo-diphtheria cases the membrane was limited to the tonsils in 5 only, and in 3 it extended to the larynx. Of the 62 cases of scarlet fever alone, 8 died (13 per cent.), of the cases of scarlet fever with diphtheria 6 died (50 per cent.), of the 23 cases of scarlet fever with pseudo-diphtheria 5 died (22 per cent.). In a previous series of 86 cases of scarlet fever, of which 19 were complicated with membranous throats, but no bacteriological examination was made, the mortality in the latter group was 47 per cent., while in the 67 cases without membranous throats only 4½ per cent. died.

In Morse's paper are probably included some of the cases reported by Williams, as the observations of both are from the Boston City Hospital. Morse reports 99 cases of pseudo-membranous inflammation of the throat complicating scarlet fever. Of these 26 per cent. died. The Loeffler bacillus was found in 23, with a mortality of 43 per cent., and was not found in 76, with a mortality of 21 per cent. In the pseudo-diphtheric cases streptococci were present in 61, staphylococci (in 12 alone and in 57 with streptococci) in 69, and other bacteria in 3 cases. Mention has already been made of the large number of staphylococcus cases in general in Morse's statistics.

It is the opinion of Morse, and of Councilman, under whose direction Morse worked, that the large proportion of cases of combined scarlatina and diphtheria was due to contagion in the hospital where the conditions were unfavorable for proper isolation. These unfavorable conditions will be remedied in the new hospital for infectious diseases now building. A few of the mixed cases, however, were admitted with double infection as shown by bacteriological examination at entrance. Most of the cases came from tenement-houses. In Williams' cases the fact that 35 came from two public institutions may explain in part the large number of associated infections.

In contrast with these results in Boston it is interesting to note the observations of Booker, already cited, at a time and place in which diphtheria was notably absent. It is evident that the proportion of cases in which true diphtheria complicates scarlet fever depends largely upon local conditions, these relating to the prevalence of diphtheria and the opportunities for contagion.

Booker reports three cases of pseudo-membranous inflammation

accompanying measles. In all, streptococci and the staphylococcus aureus were found, and in none the Loeffler bacillus. These cases occurred during the same period as the scarlatinal cases, when the city was exceptionally free from diphtheria. In two cases the membrane was limited to the larynx, there being no visible exudate. One of these was fatal, and at the autopsy the whole larynx was covered by a tough, very loosely adherent, false membrane. Both microscopical examination and cultures of the membrane after death, as well as those made from the pharynx during life, failed to show Loeffler bacilli. This case, therefore, is a particularly conclusive one of the occurrence of membranous laryngitis without diphtheria. The third case presented pseudomembrane on the tonsils, pharynx and conjunctivæ. Streptococci predominated with some colonies of the staphylococcus aureus.

In Park's first series of cases there is one case of laryngeal diphtheria accompanying measles. Loeffler bacilli were present. The child recovered after intubation. In another case, in which there was membranous laryngitis without diphtheria bacilli in the pharynx, measles developed on the eighth day. Intubation had been performed and was followed by recovery.

Williams reports one case of measles with diphtheria. This case, however, may be the same one as appears in Morse's statistics, who reports four cases of measles with severe throat symptoms giving rise to the clinical diagnosis of diphtheria. One contained a few Loeffler bacilli and many staphylococci. Of these two died. Six cases had measles and scarlet fever together, but it does not appear that any of these had membranous throats. All recovered, and the Loeffler bacillus was not found in any. Streptococci were present in 5, staphylococci in 2, and the diplococcus lanceolatus in 2.

Of particular interest are four cases of typhoid fever complicated by diphtheria, reported by Morse. At least three of the cases developed diphtheria after admission to the hospital. One was a patient ill with typhoid fever in a private room. A nurse, several days after leaving the scarlet fever ward, had a sore throat, and was put in the same room over night. On the discovery of the Loeffler bacillus in her throat the next day, the nurse was transferred to the diphtheria ward. Four days later the patient with typhoid fever developed sore-throat with membrane containing the Loeffler bacillus. The next day a typical scarlet-fever rash developed, which was followed by desquamation. She ultimately recovered. One of the four patients died. At the autopsy were found lesions of typhoid fever with diphtheritic pharyngitis, tonsillitis and laryngitis. Loeffler bacilli were demonstrated both *intra vitam* and *post-mortem*. In addition, typhoid bacilli and general streptococcus infection were found in cultures after death. Wagner has already

called attention to the greater frequency of pseudo-membranous affections in typhoid fever when diphtheria is prevalent.

PSEUDO-DIPHTHERIA.—The name pseudo-diphtheria is used by Park, Williams, and others to designate pseudo-membranous inflammations of the throat and air-passages not caused by the bacillus of diphtheria. The name is, for several reasons, objectionable, but no convenient substitute has been suggested. The term streptococcus diphtheritis fits most of the cases, but not all. The pseudo-diphtheria bacillus is not concerned in the causation of pseudo-diphtheria, or, if so, only in a very small number of cases.

We have just seen that the great majority of cases of pseudo-membranous angina in scarlet fever are due to streptococci, although under special conditions the proportion of diphtheritic cases may be exceptionally large.

The statistics as to the proportion of cases of pseudo-membranous inflammations of the throat not due to the diphtheria bacillus, exclusive of scarlatinal cases, occurring in New York and Boston, have already been given under the headings "Proportion of Cases of Suspected Diphtheria Proved to be Diphtheria," and "Membranous Croup." From these it appears that from about 28 to 40 per cent. of the cases of non-scarlatinal pseudo-membranous anginas are pseudo-diphtheria, the percentage in some series being larger and in others smaller. The high percentage of such cases in Park's first series is altogether exceptional and probably due to special circumstances, among which Park mentions particularly the prevalence of scarlatina, the relative infrequency of true diphtheria, and the season of the year (February and March). Park writes that since then he has found the diphtheria bacillus in a series of cases in over 80 per cent.

Several foreign writers have been impressed with the large number of American cases of pseudo-membranous angina and laryngitis in which diphtheria bacilli were not found, and have expressed some doubt as to the accuracy of the results. We attribute the striking differences in the reported statistical results of different investigators mainly to the class of cases selected for examination. If only typical and characteristic cases of diphtheria, be selected, as has been done by some observers, the proportion of cases in which the diphtheria bacillus is missed will be small, and may be *nil*. If, however, the less characteristic cases of diphtheria, concerning which, in many instances, no one can be sure without bacteriological examination whether they are genuine diphtheria or not, be included, there may be a relatively large percentage of cases of pseudo-diphtheria. Foreign statistics, based upon the examination of cases admitted to the diphtheria wards of hospitals, in which cases, therefore, the clinical diagnosis is diphtheria, such as the statistics

of Baginsky, in Berlin, Martin, in Paris, and Jansen, in Switzerland, agree substantially with the New York and Boston statistics.

Koplik and Park describe with much detail the anatomical and clinical characters of the less characteristic diphtheritic and of the pseudo-diphtheritic cases. Koplik's observations as to the former have already been cited. In these less characteristic cases neither the location nor the character of the diphtheritic inflammations of the throat suffice to distinguish positively the true from the false diphtherias, and a positive diagnosis must rest upon the bacteriological examination.

In the great majority of cases which have been examined with sufficient care, a streptococcus, not differing apparently from the streptococcus pyogenes or erysipelatis, has been the predominant organism in pseudo-diphtheria and is believed to be the cause of this affection. In a small number of cases generally, but in Morse's examinations in a large number of cases, staphylococci appear to have been the causative micro-organism. In a still smaller group of cases the diplococcus lanceolatus has been assigned as the causative factor. Koplik has met the coccus of Roux and Yersin. He also reports four cases of tonsillitis without membrane in which the pseudo-diphtheria bacillus was found without the typical virulent diphtheria bacillus.

Park reports the mortality in 408 consecutive cases of pseudo-diphtheria bacteriologically examined in New York, and not complicating scarlet fever, to have been only 1.7 per cent. Of the seven fatal cases only two were over five years of age. The five deaths in young children were all in laryngeal cases. He considers that nearly all of the deaths in pseudo-diphtheria are due to complications, the most important being scarlet fever, membranous laryngitis, and broncho-pneumonia. At the same period the mortality from true diphtheria in New York was 27 per cent.

In striking contrast to this low mortality in pseudo-diphtheria is that found by Morse in the Boston City Hospital, where 25 per cent. of the pseudo-membranous cases without Loeffler bacilli and without scarlet fever died. The difference between Park's and Morse's results is probably to be explained by the fact that Park's cases were largely the usual mild ones in private practice, whereas Morse's cases were of sufficient severity to be sent to the hospital, many being laryngeal cases, and many dying within twenty-four hours after admission, the great majority being young children from crowded and insanitary tenement districts. The mortality in true diphtheria uncomplicated with scarlet fever was in Morse's cases 41 per cent. Park also has noted the greater mortality of pseudo-diphtheria in the hospital cases as compared with those in private practice.

As is well known, there is much difference of opinion among physicians as to the contagiousness of throat affections due to streptococci and other cocci. In order to determine this point, the Health Department of New

York, as reported by Park, investigated 113 consecutive cases of pseudo-diphtheria occurring in 100 families, and at the same time 70 consecutive cases of diphtheria in 50 families. A history of contact with another case was found in 14 of the 113 cases of pseudo-diphtheria, and in 33 of the 70 diphtheria cases. In 9 of the 100 families with pseudo-diphtheria there was more than one case, and in 13 of the 50 families with diphtheria there was more than one case. It did not seem in an investigation of 500 cases of pseudo-diphtheria that secondary cases were any less liable to occur where the primary case was isolated than where it was not. It is considered that where two cases occurred in a family together, or within a short period of each other, they may have been due to some common exposure rather than to direct contagion. Park believes that in the majority of cases of pseudo-diphtheria the streptococci concerned are those already existing in the healthy throat, and that the presence of certain infectious diseases and exposure to cold, dampness, and insanitary surroundings, are among the exciting causes. While not denying the possibility of contagion, he considers that the degree of communicability is only moderate and of minor importance. Even admitting the possibility of contagion, he argues that the very slight mortality in uncomplicated pseudo-diphtheria justifies the rule of the Health Department in not keeping this class of cases under supervision after they have been proved bacteriologically not to be true diphtheria. The question of isolation is thus left to the discretion of the attending physician.

That a comparatively small number of cases of membranous croup are due to streptococci has already been stated. Woods has reported two cases of croupous conjunctivitis following measles, in which streptococci, but no Loeffler bacilli, were found.

Persistence of Diphtheria Bacilli in the Throat during and after Convalescence from Diphtheria.—During the ten months preceding May, 1894, Park with his co-workers in the Health Department of New York has examined 752 cases of diphtheria with reference to the length of time the diphtheria bacilli remain in the throat. Cultures were made at the beginning of the disease, and again at short intervals after disappearance of the exudate, until the throat was found free of diphtheria bacilli. The custom was to make the second culture three days after the complete disappearance of the membrane, and then to repeat the culture as long as necessary every fourth or fifth day. In 325 of these 752 cases the diphtheria bacilli disappeared within three days after the complete disappearance of the exudate; in 427 cases the diphtheria bacilli persisted for a longer time, viz: in 201 cases for 5 to 7 days; in 84 cases for 12 days; in 69 cases for 15 days; in 57 cases for 3 weeks; in 11 for 4 weeks, and in 5 for 5 weeks. In a case recently communicated to the writer by Park the bacilli were found 7 weeks after disappearance of the membrane.

The virulence of the diphtheria bacilli after recovery is reported by Park in 14 cases, the bacilli being obtained at intervals of 10 to 44 days after the inception of the disease. Eight guinea-pigs died within 40 hours, and one in each of the following periods: 60–70 hours, 5 days, 8 days, 9 days, 11 days, and 14 days. One guinea-pig survived after extensive local necrosis. He concludes that the diphtheria bacilli which persist in the throat after an attack of diphtheria are always virulent for some time. In those exceptional cases in which the bacilli persist for a very long time they are found occasionally to lose their virulence a few days before their final disappearance, while in other cases they retain their virulence to the end. In one case the bacilli were virulent 8 weeks after the onset of the disease and 7 weeks after the disappearance of the membrane. That the cases themselves do not seem so liable to spread diphtheria is probably largely on account of the relatively small number of the bacilli in the convalescent throats, as compared with those showing the lesions of diphtheria. Reference has already been made to the rule of the Health Department to keep cases of diphtheria under supervision until the diphtheria bacilli have disappeared, and to practise disinfection as soon as they have vanished from the throat.

Park reports that thorough irrigation of the throat and nose with 1 to 4000 bichloride of mercury solution every few hours was attended by disappearance of the bacilli within three or four days after disappearance of the false membrane in from one-half to two-thirds of the cases. In the remaining cases the bacilli persisted from four to twenty days, notwithstanding the application of the bichloride solution. The duration of persistence of the bacilli with irrigation with simple salt-water was three days less than with bichloride irrigation.

Where cultures cannot be made it is recommended to continue the isolation of diphtheria patients for at least three weeks after the disappearance of the membrane.

Morse investigated twenty-five cases of diphtheria with reference to the length of time the diphtheria bacilli persist in the throat and nose. He found the average duration of their presence after disappearance of the membrane to be ten days, and this to be the same for both throat and nose, although they were found longer in the throat in some cases, and in the nose in others. The bacilli disappeared in one case the day after the throat was clear; in three, three days after, and in one, four days after. In two cases in which the bacilli were never found in the nose, they remained in the throat ten and seventeen days respectively. In other cases they were present: in the throat thirty-seven days, in the nose thirty-six days; in the throat twenty-two days, in the nose eighteen days; in the throat ten days, in the nose seventeen days; and in both twenty-seven days. The bacilli obtained after ten days were found of usual virulence; in other cases of this group the virulence is not

recorded. Patients are not permitted to leave the hospital until the diphtheria bacilli have disappeared from both throat and nose.

PRESENCE OF DIPHTHERIA BACILLI IN HEALTHY THROATS OF PERSONS EXPOSED TO DIPHTHERIA.—An interesting investigation has been carried out by Park to test the frequency with which the healthy throats of children contain diphtheria bacilli in families where a case of diphtheria exists and where little or no isolation is undertaken. The throats of fourteen families were investigated, in which there were forty-eight children. In 50 per cent. of these virulent diphtheria bacilli were found; 40 per cent. developed later, to a greater or less extent, the lesions of diphtheria. It is noted in Park's paper that, in these families, the conditions were the best possible for the transmission of the bacilli from one to the other. In families where the case of diphtheria was well isolated, the bacilli were found in less than 10 per cent. of the children.

The cases, as well as others to be mentioned presently, in which virulent diphtheria bacilli are found, sometimes in large number, in healthy throats of persons who do not develop diphtheria, prove that virulent diphtheria bacilli may be present in the throat and multiply there without causing any visible lesions. As has recently been pointed out with much clearness by Escherich, in order to cause diphtheria they must find susceptibility to their pathogenic action, which susceptibility may be local, or general, or both.

It is, for several reasons, of practical value to make bacteriological examinations of the healthy children's throats in families where diphtheria has developed, or who have been exposed to diphtheria, especially where isolation is defective. Experience has shown, as appears from Park's paper, that antiseptic irrigations and cleansing treatment of the throat in such cases greatly reduce the liability to develop diphtheria.

The dissemination of the disease is prevented by isolating those in whom the diphtheria bacilli are found. Doubtless, not a few cases of diphtheria of obscure causation are referable to those who without the symptoms and lesions of diphtheria carry about the virulent bacilli.

Park says: "All members of an infected household should be regarded as under suspicion, and in those cases where isolation is not enforced the healthy as well as the sick should be prevented from mingling with others until cultures or sufficient lapse of time give the presumption that they are not carriers of contagion."

For interesting illustrative cases and further details on this important matter, Park's paper should be consulted.

PRESENCE OF DIPHTHERIA BACILLI IN HEALTHY THROATS WHERE NO HISTORY COULD BE OBTAINED OF EXPOSURE TO DIPHTHERIA.—Park and Beebe examined the healthy throats of three hundred and thirty persons in New York who gave no history of direct contact with diph-

theria. They found non-virulent, but otherwise characteristic, diphtheria bacilli in twenty-four, virulent characteristic diphtheria bacilli in eight, and non-virulent pseudo-diphtheria bacilli in twenty-seven. The virulence was tested by inoculating half-grown guinea-pigs with ½ to 1 per cent. of their weight of forty-eight-hour bouillon cultures grown at body temperature. The non-virulent diphtheria bacilli produced acid in bouillon, and did not differ morphologically or in cultures from virulent diphtheria bacilli. Such bacilli are not regarded by Park as pseudo-diphtheria bacilli, but as genuine diphtheria bacilli devoid of virulence. The pseudo-diphtheria bacilli usually clouded bouillon and did not render it acid, and presented the usual characters of the pseudo-diphtheria bacilli to be described subsequently.

The non-virulent but otherwise characteristic diphtheria bacilli were abundant in the primary cultures from seventeen throats, and present in small number in the cultures from seven. In only one guinea-pig was there appreciable reaction after inoculation. Two hundred and eighty of the cases from which the cultures were made were children under twelve years of age (bacilli in twenty-two cases), while fifty were adults (bacilli in two). The non-virulent diphtheria bacilli persisted in four of the throats for four weeks, in one for three weeks, and in three for two weeks.

Of the eight cases in which virulent diphtheria bacilli were found, five were children in an asylum where from time to time cases of true diphtheria had occurred. Of the remaining three, one was from a house where a case of supposed croup had existed three weeks before. Two of the eight children developed diphtheria some days after making the cultures. The other six never developed any symptoms of diphtheria. The guinea-pigs inoculated with the cultures died in from twenty-eight to forty hours.

From the groups of cases studied under this and the preceding headings Park concludes that virulent diphtheria bacilli are present in probably about 1 per cent. of the healthy throats in New York City. Most of the persons in whose throats they exist have been in direct contact with cases of diphtheria. Many of those whose throats contain the virulent bacilli never develop diphtheria.

Occurrence of Diphtheria Bacilli Outside of the Human Body.—In his first paper Park says that cultures made from the dried stains on spreads, pillow-cases, and sheets, where soiled by the expectoration of diphtheria patients, showed in every case a few colonies, at least, of the Loeffler bacillus. The sputum of patients, though apparently free from bits of membrane, usually contained the bacilli in large number.

Important results have been obtained by Wright and Emerson, who have kindly furnished the writer an abstract of their unpublished work so far as it has yet been carried. They made cultures on blood-serum

from the clothing, shoes, hair, and finger-nails of nurses in attendance on diphtheria patients, and also from the dust and various objects within the diphtheria ward of the Boston City Hospital. This ward contains seventy beds, which are generally nearly all occupied. The hygienic condition of the ward is stated to be good. Material, such as dust, etc., was collected for the most part on a sterilized platinum wire and applied to the surface of the culture medium. About twenty cultures in all have been made, of which five yielded Loeffler bacilli in small numbers. In all of the positive cases the bacilli isolated in pure culture were tested thoroughly as to their virulence and their morphological and cultural characters, and positively identified. In the latter respect all were characteristic diphtheria bacilli. It may be especially noted that all rendered bouillon acid within forty-eight hours. In two of the five cases the bacilli were of usual virulence, in two they were weakened in virulence, although killing guinea-pigs, and in one they caused only local reaction from which the animal recovered. The virulence was tested by inoculating guinea-pigs subcutaneously with ½ to 1 per cent. of their weight of twenty-four- to forty-eight-hour bouillon cultures. From eight inoculated guinea-pigs which died, the characteristic bacilli were recovered in each instance, even when death occurred after some weeks.

The Loeffler bacilli were found on three shoes, each belonging to a different nurse, once on the hair of a nurse, the culture being taken from the hair above the ear, and once on a brush used in sweeping the floor of the ward.

The weakening of the virulence in two cases (in one case the guinea-pig died after seven and one-half days, and in another after some weeks, bacilli from each being recovered from the seat of inoculation) and the production of only slight local reaction from which the animal recovered in the case in which the bacilli were found on the hair of a nurse, suggest attenuation of virulence by unfavorable environment.

These suggestive observations of Wright and Emerson tell their own story and need no special comment.

No observations have been reported in this country of diphtheria as a spontaneous affection of domestic animals. Abbott was unable to confirm Klein's observations of the elimination of diphtheria bacilli through the milk of cows inoculated with virulent cultures of the Loeffler bacillus.

Methods of Dissemination of Diphtheria.—How manifold may be the modes of conveyance of the diphtheria bacillus, and how obscure and difficult or even impossible to trace may be the origin of some cases of diphtheria, is evident from observations which have been mentioned. Park from his rich experience summarizes and illustrates with interesting examples some of the ways in which the diphtheria germ may be transported.

Here we cannot do more than enumerate some of the sources of infection which have been established by bacteriological investigations, to wit: the pseudo-membranes, exudates and discharges of diphtheria patients, both those with typical diphtheria and those with mild and little characteristic forms of the disease; infected clothing, bedding, and other objects; occupying rooms where diphtheria has existed; convalescent or recovered cases in whom the diphtheria bacilli persist; persons who have been in contact with others having diphtheria bacilli on their persons or clothing, or with infected objects, such persons sometimes carrying diphtheria bacilli in their throats for days or weeks without lesion. The investigations of Wright and Emerson show on what varied objects the diphtheria bacilli may be carried. Park traced one group of cases of diphtheria to a candy-store kept by a family in which occurred a case of diphtheria. Children who bought candy at this store acquired diphtheria, and other children who came in contact at school with the healthy children of this family also developed diphtheria.

The investigations of the Health Department indicate that at present the whole tenement-house district of New York is an infected area. In plotting out on a map the distribution of cases of diphtheria in New York it was interesting to note two types of epidemics, one essentially of neighborhood infection, the other in which the cases could be attributed to infection at school. It was observed that a whole school district would suddenly become the seat of scattered cases. At times, in a certain area of the city from which several schools drew their scholars, all the cases of diphtheria would occur in families whose children attended one school, the children from the other schools being for a time exempt.

In about one-half of the cases of diphtheria in New York careful inquiry failed to show connection with other cases.

Influences which increase susceptibility to diphtheria doubtless play a rôle in determining the development of the disease. The majority of adults and many children are insusceptible. What these predisposing influences are we do not know, save the influence of age. That special local conditions, the presence of throat affections and the association of the diphtheria bacillus with other micro-organisms, particularly streptococci, are predisposing factors seems highly probable. It is also probable that the degree of virulence of the diphtheria bacillus and the number of bacilli received into the body must be taken into account.

We possess no evidence that the diphtheria bacillus finds a natural home outside of the human body, although it may survive for months on objects outside of the body. Park found living diphtheria bacilli on bits of membrane dried for seventeen weeks, and in blood-serum cultures seven months old.

Pseudo-diphtheria Bacillus.—The various questions relating to the pseudo-diphtheria bacillus have been investigated by Abbott, Koplik, and Park.

In fifty-three cases of various throat affections, mostly without suspicion of diphtheria, examined bacteriologically by Abbott, he found in three bacilli indistinguishable morphologically or in cultures from the Loeffler bacillus, but entirely devoid of virulence, as tested repeatedly on guinea-pigs. One of the cases was suspicious of diphtheria, there being a grayish membrane on the tonsils; one was a case of syphilitic pharyngitis without membrane, and the other was follicular tonsillitis. From a fourth case of this series with a grayish-white deposit on the tonsils, Abbott cultivated a bacillus resembling the Loeffler bacillus, but somewhat thicker, growing more luxuriantly on agar, clouding bouillon and growing visibly on potato, exceptionally invisibly. This bacillus was wholly non-pathogenic for guinea-pigs. As already mentioned, Abbott and his pupil, Ravenel, have found in two cases of membranous rhinitis bacilli indistinguishable from the Loeffler bacillus except that they failed to kill guinea-pigs, although producing local reaction.

Abbott's conclusion is that the diphtheria bacillus varies in its virulence and that non-virulent varieties of the bacillus occur. He says that the name pseudo-diphtheria bacillus should not be applied to those bacilli which possess all of the morphological and cultural characters of the Loeffler bacillus and are devoid of virulence. These are simply non-virulent diphtheria bacilli. He reserves the term pseudo-diphtheritic bacillus "for that organism or group of organisms (for there are probably several) that is enough like the diphtheria bacillus to attract attention, but is distinguishable from it by certain morphological and cultural peculiarities aside from the question of virulence."

Koplik does not seem to have met with a bacillus presenting all the morphological and cultural properties of the virulent diphtheria bacillus but devoid of virulence. He emphasizes the importance, in testing virulence, of observing the precautions especially signalized by Behring and by Escherich, as already mentioned, and gives examples showing that mistakes on this point can readily be made where old cultures and insufficient doses are used. Koplik has, however, in six cases out of a large number examined found the pseudo-diphtheria bacillus essentially as described by Hoffmann, and he would limit the name pseudo-diphtheria bacillus to the bacillus presenting these definite characters. This pseudo-diphtheria bacillus he describes in his first article as shorter and slightly plumper than the real bacillus, but subsequently he describes it as an exact counterpart of the Loeffler bacillus in shape, size, and staining peculiarities, with the exception of deeper staining with methylene-blue. Actual measurements do not show any constant difference in thickness or length from the Loeffler bacillus. It grows upon blood-serum, potato, and gelatin, like

the genuine bacillus. Upon agar the growth is always more luxuriant, thicker and whiter than that of the real bacillus. In alkaline peptone bouillon the pseudo-bacillus causes in twenty-four hours diffuse clouding with abundant deposit. The reaction remains distinctly alkaline. Koplik communicates to the writer an unpublished observation to the effect that if the pseudo-bacillus be cultivated in closed tubes of Pasteur pattern, from which the oxygen has been absorbed by pyrogallate of potassium, there is an abundant sediment with diffuse clouding of the bouillon, and in forty-eight hours the reaction is found to be acid. Neither aërobic nor the acid anaërobic cultures are lethal to guinea-pigs, even in enormous doses. Nor does the preparation of an animal for weeks by the injection of such repeated doses protect it from the effects of small doses of a fresh culture of the virulent bacillus. This was proved not only upon guinea-pigs, but also upon sheep and dogs. Koplik's first article is illustrated with beautiful photographs of the real and the false diphtheria bacilli in microscopical specimens and in cultures. It contains also a very satisfactory photograph of involution forms of the diphtheria bacillus.

The pseudo-bacillus was found by Koplik in four cases, already mentioned, with inflammation of the tonsils, without the real bacillus. In two cases of lacunar tonsillar diphtheria virulent typical diphtheria bacilli persisted in the crypts, in one case for three weeks, and in the other case for two weeks. At the end of these periods the virulent bacillus gave place to a non-virulent bacillus indistinguishable morphologically from the real bacillus, but presenting the cultural characters above described of the pseudo-bacillus, this bacillus being found abundantly in exactly the same situations in which the virulent bacillus previously existed. These non-virulent bacilli persisted in the tonsillar lacunæ up to the sixth week after the onset of the illness in one case. Koplik suggests the possibility that under the influence of the lymph and leucocytes of the tonsils, the virulent bacillus was transformed into the non-virulent form. He considers, however, the relationship between these two bacilli to be still an open question, but upon the whole he seems to be of the opinion that they are distinct species. When found, the pseudo-diphtheria bacilli were abundant in the cultures. Koplik's results may be said to be confirmatory of those of Escherich.

Park found, in 20 cases diagnosticated as diphtheria, the bacilli to be virulent in all, but in three of these cases the cultures from the first colony selected, although characteristic, were not virulent, while from other colonies in the same cases they were fully so. As already stated, Park used in testing virulence forty eight hours' broth cultures injected in doses of one-quarter to one-half or even one per cent. of the body-weight of the guinea-pig—selecting, where possible, young guinea-pigs. Park, therefore, confirms the observation of Roux and Yersin as to the pos-

sible coexistence of virulent and non-virulent bacilli in the same throat. He considers that in suspicious cases one should not be content with cultures from a single colony, if this should prove not to be virulent.

In this connection it may be mentioned that Park found no definite relation between the virulence of the cultures and the severity of the case. Nor was he able in an extended research to discover a relationship between the size of the bacillus and its virulence such as has been claimed by some investigators. He states that the results of 1613 cultures in which this factor was carefully noted in relation to the severity of the case indicate that in New York the great majority of cases of diphtheria yield in cultures bacilli of medium size which are characteristic in shape and in manner of staining, and that in a moderate number the bacilli are much longer, and in about an equal number they are much shorter. Both clinical histories and animal experiments showed that as long as in shape and staining the bacilli are characteristic, nothing as regards their virulence can be judged from their size. Those bacilli, on the other hand, which are short and stain uniformly with methylene-blue usually turn out to be of the pseudo-diphtheria type which have no virulence in animals.

It has already been mentioned that Park found exceptionally in cases in which diphtheria bacilli persisted in the throat a long time after recovery from diphtheria, attenuation of virulence to a point in which the cultures, although producing local reaction, failed to kill guinea-pigs.

We have cited already the investigations of Park and Beebe upon the healthy throats of 330 persons who gave no history of direct contact with diphtheria. In 24 of these they found bacilli indistinguishable from the diphtheria bacillus except by absence of virulence, which was tested by injecting forty-eight-hour broth cultures in doses of one-half to one per cent. of their weight into half-grown guinea-pigs. In 19 of these 24 cases the bacilli were grown in broth. In all of these the bacilli formed acid by their growth in forty-eight hours, sometimes more, sometimes less acid than control cultures of virulent bacilli. In 13 the broth culture was entirely characteristic, like that of the virulent bacillus, while in 6 the culture became more or less clouded, an effect which is exceptionally produced also by the virulent bacillus. No difference was found as to the growth on blood-serum. Upon agar the growth was typical of that of the virulent bacillus in 11 cases, while from 7 the bacilli grew in a less typical manner, but always in ways seen occasionally with the virulent form. Of the guinea-pigs inoculated with cultures from 15 of the cases, in only one was there any appreciable local reaction, and this subsided within four days. A very slight degree of immunity seemed to be afforded to some of the guinea-pigs by the injection.

In 27 cases the pseudo-diphtheria bacillus, which, as well as the genuine diphtheria bacillus, has been most satisfactorily photographed in cover-

slip specimens and cultures by Park, was found presenting in general the characters described above. Park describes this bacillus as shorter and thicker and more uniform in size and staining than the virulent Loeffler bacillus. It clouded and formed alkali in bouillon in the first forty-eight hours, grew more luxuriantly on agar, and was not pathogenic. Park would confine the name pseudo-diphtheria bacillus to the bacillus or group of bacilli presenting these general characters.

Park, as well as Abbott, therefore, recognizes a non-virulent form of the diphtheria bacillus, and contends that bacilli indistinguishable from the diphtheria bacillus except by absence of virulence, should not be called pseudo-diphtheritic. He admits certain morphological and cultural variations of the true diphtheria bacillus, such as variations in size, occasional clouding of bouillon, exceptional luxuriance of growth on serum and agar, etc., but the production of acid in bouillon he regards as essential to the diagnosis of the diphtheria bacillus.

The pseudo-diphtheria bacillus, as defined above, is regarded by Park as a species distinct from the genuine diphtheria bacillus, either in its virulent or its non-virulent state. Park calls attention to the confusion introduced into the discussions on the pseudo-diphtheria bacillus by the fact that some have given this name to bacilli indistinguishable from the diphtheria bacillus except by absence of virulence, whereas others have worked with the genuine pseudo-diphtheria bacillus, which presents cultural and morphological differences from the genuine diphtheria bacillus.

It would seem to be established, therefore, by the investigations of Abbott and Park, that a bacillus in no way distinguishable from the diphtheria bacillus except by absence of virulence exists. Although other investigators have included this non-virulent but otherwise characteristic diphtheria bacillus under the designation pseudo-diphtheria bacillus, they contend that this name is inappropriate for this bacillus, which should be considered as the genuine diphtheria bacillus, which may present all degrees of virulence down to complete harmlessness, as tested on guinea-pigs. This non-virulent bacillus has been found only in a comparatively small number of cases, these cases being chiefly without characteristic lesions of diphtheria. Occasionally the virulent and the non-virulent diphtheria bacilli are found side by side in diphtheria, and occasionally the virulent bacillus has given place to the non-virulent bacillus during or after recovery from diphtheria.

Abbott, Koplik, and Park would limit the name pseudo-diphtheria bacillus to bacilli which, although bearing resemblance to the diphtheria bacillus, differ from it not only by absence of virulence toward guinea-pigs but also by cultural characteristics.

Abbott considers that there is a group of bacteria which in this sense may be called pseudo-diphtheritic, and that they are distinct species from the diphtheria bacillus. Koplik describes with much detail a special

bacillus observed by him in six cases, which he considers to be identical with the original pseudo-diphtheria bacillus of Hoffmann, and to which he would limit the name pseudo-diphtheria bacillus. This bacillus grows on agar more luxuriantly than the genuine diphtheria bacillus, and it does not change the reaction of alkaline glucose bouillon in aërobic cultures, although it produces acid in anaërobic cultures. While not expressing a positive decision, he seems inclined to regard this bacillus as distinct in species from the genuine diphtheria bacillus.

Park has probably worked with the same bacillus, at least the same as the one described by Koplik in his first article, and he also would limit the name pseudo-diphtheria bacillus to this bacillus, or to a group of bacilli presenting these several characteristics, if, as is probable, such a group exists. He considers that this bacillus, or these bacilli, differ from the genuine diphtheria bacillus at least as much as the colon bacillus differs from the typhoid bacillus. The pseudo-diphtheria bacillus was found in only a small number of cases out of the many examined, and appeared to have nothing to do with diphtheria.

SUMMARY.—This paper is a report of the results of the bacteriological study of diphtheria in the United States up to May, 1894, so far as these results are of interest for the purposes of this Congress. The investigations were made by various men in New York, Baltimore, Boston, and Philadephia.

Some of the more important conclusions may be summarized as follows:

1. The Health Department of New York has undertaken the bacteriological examination of all cases of suspected diphtheria in that city, unless objection is made by the attending physician or unless it is not deemed advisable to disturb the patient by such examination. The methods employed are described in detail. During the year ending May 4, 1894, cultures were made from 5611 cases of suspected diphtheria. The results have proven satisfactory, and are utilized not only for diagnosis, but also to control the supervision and isolation of the cases.

2. Of 6156 cases of suspected diphtheria in New York and Boston, 58½ per cent. were proven bacteriologically to be true diphtheria—or, if we include only those cases in which the bacteriological examination was considered to be entirely satisfactory—of 5340 cases, 67½ per cent. were true diphtheria. These were pseudo-membranous inflammations of the throat and air-passages uncomplicated for the most part with scarlet fever.

3. At least 80 per cent. of the cases of membranous croup in New York were diphtheria, and only 14 per cent. were shown not to be diphtheria.

4. Fifteen cases of fibrinous rhinitis and 4 cases of primary and exclusively nasal diphtheria were all due to the diphtheria bacillus.

5. Various forms of atypical diphtheria, many without membrane, and with the characters of simple catarrhal angina and follicular tonsillitis, are described.

6. Instances of unusual localizations of the diphtheria bacillus, as in the middle ear, in wounds, ulcers, abscesses, conjunctivæ, lungs, heart-valves, and the distribution of the bacilli at autopsies of human beings and of guinea-pigs dead of diphtheria, are described.

7. The various bacteria found associated with the diphtheria bacillus, the most important pathogenic forms being streptococci, staphylococci, and the diplococcus lanceolatus, are considered.

8. In general the great majority of cases of pseudo-membranous anginas in scarlet fever are due to streptococci, but where diphtheria is prevalent and opportunities are favorable for exposure to diphtheria a large proportion may be due to the diphtheria bacillus. The statistics in Baltimore and in Boston present interesting contrasts in illustration of this point. Four cases of diphtheria complicating typhoid fever are described.

9. The name pseudo-diphtheria is applied to pseudo-membranous inflammations of the throat and air-passages not caused by the diphtheria bacillus. The most important and common micro-organism in pseudo-diphtheria is the streptococcus pyogenes, but other bacteria may be the cause. The mortality in these affections is low in private practice, being 1.7 per cent. in 408 consecutive cases in New York. In hospitals it may be as high as 25 per cent. Death is generally due to some complication, the most important complications being scarlet fever, membranous laryngitis, and broncho-pneumonia. The disease seems to be only slightly, if at all, contagious. For this reason, and on account of the low mortality in uncomplicated cases, those cases which are proved bacteriologically not to be true diphtheria are not kept under supervision by the Health Department in New York. Until such proof suspicious cases are treated as diphtheria.

10. Of 752 cases of diphtheria in New York, the diphtheria bacilli in 325 disappeared within three days after the complete disappearance of the exudate. In 427 cases the bacilli persisted for a longer time, viz., in 201, for from five to seven days; in 84, for twelve days; in 69, for fifteen days; in 57, for three weeks; in 11, for four weeks; and in 5, for five weeks. In one case, virulent bacilli were found seven weeks after disappearance of the exudate. The cases are kept under supervision until the bacilli have disappeared. Sometimes they disappear first from the nose; at other times, first from the throat.

11. In fourteen families, with forty-eight children, where little or no isolation of a case of diphtheria in each family was undertaken, virulent

diphtheria bacilli were found in 50 per cent. of the children, of whom 40 per cent. later developed diphtheria. The bacilli were found in less than 10 per cent. of the children in families where the case of diphtheria was well isolated.

Antiseptic irrigation and cleansing treatment of the throat lessens the liability of those thus exposed to develop diphtheria.

All members of an infected household should be regarded as under suspicion, and where isolation is not enforced the healthy as well as the sick should be prevented from mingling with others until cultures or sufficient lapse of time give the presumption that they are not carriers of contagion.

12. Diphtheria bacilli may be present and multiply in the throat without causing symptoms or lesions. They must find susceptibility to their pathogenic action in order to cause diphtheria.

13. In three hundred and thirty persons who gave no history of direct contact with diphtheria, virulent diphtheria bacilli were found in eight, of whom only two subsequently developed diphtheria. Bacilli, indistinguishable morphologically or in cultures from the diphtheria bacillus, including the formation of acid in forty-eight hours in bouillon, but entirely devoid of virulence, were found in twenty-four of these persons, in most of these instances in large numbers. The pseudo-diphtheria bacillus was found in twenty-seven.

14. Instances are given in which the diphtheria bacilli were found on various objects outside of the human body, viz., bed-clothing soiled with discharges of diphtheria patients; the shoes and the hair of nurses in attendance on diphtheria patients, and a brush used in sweeping the floor of a diphtheria ward.

15. Some of the various ways in which the diphtheria germ is transported are summarized.

16. A bacillus in no way distinguishable in morphology or in cultures, including the formation of acid in bouillon, from the usual diphtheria bacillus, but devoid of virulence, exists. The virulence was tested by injecting into half-grown guinea-pigs $\frac{1}{2}$ to 1 per cent. of their weight of forty-eight-hour bouillon cultures. This bacillus, although it has been called by some investigators the pseudo-diphtheria bacillus, should not be so designated. It is the genuine diphtheria bacillus devoid of virulence. It was met with in a comparatively small number of cases out of a large number examined. Exceptionally, it may occur together with the virulent diphtheria bacillus in diphtheria, and occasionally it takes the place of the virulent bacillus during or after recovery from diphtheria. In several instances it was found in healthy throats.

The name pseudo-diphtheria bacillus should be confined to bacilli which, although resembling the diphtheria bacillus, differ from it not only by absence of virulence, but also by cultural peculiarities, the most

important of the latter being greater luxuriance of growth on agar and the preservation of the alkaline reaction of bouillon cultures. The pseudo-diphtheria bacillus may render bouillon cultures acid in forty-eight hours when grown anaërobically. The pseudo-diphtheria bacillus in this sense was found in a number of cases, but not frequently. It is probably of different species from the genuine diphtheria bacillus, and is without diagnostic importance.

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REVIEWS.

A Practical Treatise on Medical Diagnosis for Students and Physicians. By John H. Musser, M.D., Assistant Professor of Clinical Medicine in the University of Pennsylvania; Physician to the Philadelphia and the Presbyterian Hospitals; Consulting Physician to the Woman's Hospital of Philadelphia and to the West Philadelphia Hospital for Women; Fellow of the College of Physicians of Philadelphia; Member of the Association of American Physicians; President of the Pathological Society of Philadelphia, etc. Illustrated with 162 woodcuts and 2 colored plates. Philadelphia: Lea Brothers & Co., 1894.

We expect to find nowadays a book written by an American physician of standing, at once of good literary quality, containing the best of what is to be found in the writings of others as well as the results of his own investigations and experience, and, above all, eminently practical. Such a book is the *Medical Diagnosis* of Musser.

It is well planned and well written. The language is clear, explicit, terse. Some of his descriptions are most excellent, and paint as vividly as words can, the picture of disease. As instances, we may mention the description of the actions of the healthy baby as compared with those of the rickety child or the sufferer from meningitis (p. 58); the description of the typhoid state (p. 107), and of internal hemorrhage (p. 177). He seems to have taken special pains to simplify the more complex and intricate subjects. We do not remember to have seen the main facts concerning the reaction of degeneration, always a puzzle to students, more clearly and succinctly stated than in this book (p. 793).

An occasional grammatical error or misspelled word has escaped the proof-reader. "Günzburg" is spelled "Günsburg." "Ponfick" is probably meant by "Pomfret" (p. 164). And on page 646, fifth line, should not "another cubic centimetre" read "another one-tenth of a cubic centimetre"? The following is also, probably, the result of a little haste in correcting manuscript: "In the initial stage of fever, sudden rise of temperature to a high degree from a condition of apparent health is against any of the infectious diseases except scarlet fever" (p. 111). The words "infectious diseases" are probably here accidentally used for "acute specific fevers"—as our author terms the exanthemata—for he distinctly includes such diseases as pneumonia, malaria, osteomyelitis, pyæmia, among the infectious diseases, and speaks of the sudden rise of temperature that so often characterizes the onset of each.

The practical nature of the work is seen on almost every page. While fully alive to the importance of many of the newer and more recent advances in knowledge, the author is not drawn away by the attractiveness of some new but not yet fully established theory from that which is well grounded in scientific clinical experience. The book

becomes, therefore, a safe guide for students, for workers in laboratories, and for bedside practitioners. Many physicians will be pleased to note that the fact is fully recognized that modern methods of examination, chemical, microscopical, bacteriological—easy of application in a hospital with numerous assistants and with laboratory and patient near together, methods often necessary to a complete and scientific diagnosis, and without which therapy, the ultimate aim of diagnosis, is but blind empiricism—frequently demand of the physician in private practice more time than he can possibly give. "The tax on the physician is far greater than a few years ago. The bedside labor is great, and in addition he must have a laboratory at his command for microscopical, chemical, and bacteriological work, The outcome is that the scientific physician must have a *clientèle* limited in number, or else have one or more assistants to aid in his investigations. Without doubt, the latter will soon occur. Not as in days of old will we find in the practitioner's office the apprentice, compounding drugs and rolling bandages, assisting in the operation of bleeding, and dressing ulcers, but the highly-trained, scientific assistant, who by labors in the laboratory and at the bedside is competent to collect data suitable for scientific methods of reasoning" (p. 21).

The first three chapters, on "General Observations," "The Data obtained by Inquiry," and "The Data obtained by Observation" will well repay careful perusal. The cautions and advice to students and young practitioners are of extreme value, and we are sure that many of maturer years would find most useful practical hints in these pages. Too often, we fear, these introductory chapters are hastily written and more hastily read, the desire of writer and reader being as soon as possible to get at the definite and specific diagnosis of particular diseases. Part I., on "General Diagnosis," is one of the best parts of the whole work. We are tempted to make liberal quotations from this portion, *e. g.*, from what is said concerning "Method of Inquiry" (p. 30), "Subjective Symptoms" (p. 32), but content ourselves with a brief extract (p. 50): "What has been thus imperfectly said is intended to emphasize the fact that no mystery attends the recognition of the objective signs of disease. Patient training, skill in techniqne, and opportunities of observing disease at the bedside are essential." We are glad to see this fact so emphatically stated, for it cannot, we think, be too early taught that there is no such thing as a diagnosis by some hidden, mysterious power—an intuitive diagnosis; that the apparently intuitive diagnosis of the skilled physician has nothing magical about it—that it is but the rapid action of the brain that works quickly because in the past it has been carefully trained to interpret the phenomena observed by all the senses. The "intuitive diagnosis" is intuitive as is the ability of the pianist to read music at sight, *i. e.*, it is the result of hard, patient training.

Following "General Diagnosis," the diseases of the various systems of the body are taken up, under "Special Diagnosis." The separate diseases are, many of them, considered very briefly indeed. This brevity, however, does not indicate scanty treatment, as the methods of examination peculiar to each system of organs are fully considered before the diseases of the special organs of that system are taken up. Here are described in compact form, yet clearly stated, the aids to diagnosis derived from bacteriology, the examination of sputum, exudates, stomach

contents, the blood—due weight being attached to the examination of stained blood preparations—the urine, etc. The value of the anamnesis, and of percussion, auscultation, inspection, etc., is fully set forth. This plan enables the author to speak very briefly of each particular disease as it is considered, as the method by which certain facts concerning the anatomical or physiological changes in an organ are learned has been already described, and can be assumed as known. Perhaps the nervous system, a most difficult subject to treat of in a work of this kind, is slighted a little. Yet the main facts are given, and with admirable clearness. The frequency with which Gowers is quoted in these pages is noticeable.

We have read this work with both pleasure and profit, for there is scarcely a page but what contains some new fact or an old fact presented in a new light, or a valuable practical hint put in such a way as to be readily remembered. A few only of the many points we have noted may be mentioned here.

We are heartily in accord with what is said concerning the value of exploratory puncture as an aid to diagnosis (p. 159 *et seq.*), and are glad to see this procedure viewed as a surgical operation, and to find stress laid upon the preparation of the instruments, the hands of the operator, and the skin of the patient, even though our author is almost fastidious in his directions concerning the aseptic operation. He justly warns against the exploratory puncturing of the acute splenic tumor of such diseases as typhoid fever, because of the danger of rupture of the organ.

"I know of no affection which is more frequently overlooked during life than pericardial effusion" (p. 394). To this might perhaps be added "and small pleural effusions."

His advocacy of the subdivision of the abdomen according to Ballance, into quadrants of a circle, with the umbilicus as a centre, and diameters passing at right angles to each other, the one coinciding with the median line of the body, and the other being the transverse umbilical line (p. 467), is timely, and warranted by its simplicity of comprehension and ease of remembrance.

In gonorrhœal rheumatism "ulcerative endocarditis may supervene. There is entire absence of heart symptoms from simple endocarditis" (of gonorrhœal rheumatism) (p. 141). There are cases of gonorrhœa with so-called gonorrhœal rheumatism and acute benignant endocarditis where symptoms of cardiac affection are present. We have seen such a case in a female, where palpitation, dyspnœa, præcordial pain, rapid pulse, and cardiac murmur, gave evidence of acute valvular endocarditis, and in which two years later the diagnosis was confirmed by the presence of cardiac hypertrophy, loud mitral systolic murmur, and signs and symptoms of beginning failure of compensation.

We predict for Musser's *Medical Diagnosis* a cordial reception. The work of Jaksch, a model of its kind, deals only with microscopical and chemical examinations; Vierordt has little or nothing concerning diagnosis with the aid of the anamnesis; Musser combines the merits of both these works, together with the lucidity and practicality of Da Costa, whom he bids fair to rival. J. B. H.

TEXT-BOOK OF ABDOMINAL SURGERY: A CLINICAL MANUAL FOR PRACTITIONERS AND STUDENTS. By SKENE KEITH, F.R.C.S. Ed.; assisted by GEORGE E. KEITH, M.B.C.M. Pp. 508. Philadelphia: The J. B. Lippincott Co., 1894.

THIS is Vol. IV. of Pentland's Medical Series, and bears the familiar impress of the excellent work done by that publisher.

In subject-matter this is a most timely book, and especially for Americans. In contrast with some recent works on gynecology, the book under discussion seems at first sombre and tame, lacking the abundant illustrations so much employed here at present. We have no picture of the authors in the act of washing their hands, and none of the public beauties of London graces the book with her nude form! However, "Good wine needs no bush"—certainly none of the sort mentioned.

Dr. Keith divides his book into two sections, the first of which treats of abdominal surgery in general, the second of abdominal surgery peculiar to women. In the matter of diagnosis he is not accustomed to use most often the dorsal posture with flexed limbs, but with extended limbs, the shoulders being low. Rectal examination seldom gives much information in his experience. In examining the urine to ascertain the patient's condition with reference to operation, he includes an estimation of the quantity of urea excreted—a rational and valuable precaution. The unenlarged spleen cannot be grasped; the kidney is to be discovered by palpation, as clearly described.

The chapter upon tapping and aspiration clearly shows the value of these procedures, which have too little place in the teaching and practice of some. The belief advanced that a patient may have acute peritonitis from catching a chill following the withdrawing of a large quantity of warm fluid by tapping is not in accord with the pathology of those who believe that acute peritonitis invariably follows the accession of an infective germ. Such writers would ascribe peritonitis following tapping to the use of an infected instrument or puncture through septic integument. The selection of the umbilicus as the site of tapping is also noteworthy. In aspiration and tapping the writer does not countenance the partial removal of fluid from cysts or from the abdomen, but urges the complete emptying of such collections. Sudden collapse from removal of intra-abdominal pressure by complete emptying of fluid, he does not mention; we have seen this prove rapidly fatal. In diagnosticating malignant growths, stress is laid upon the microscopic study of the cells contained in the fluid removed; Foulis' cells are regarded as of great diagnostic significance. Exploratory operations are held to be seldom justifiable; the author would advise consultation in obscure cases, and when immediate operation is not imperative he would wait until time sufficient to clear up the diagnosis had elapsed. This plan of action, while clearly in the patient's interest, would scarcely satisfy the ambition of many abdominal surgeons who permit no diseased abdomen coming under their inspection to go unopened.

The preparation of a patient for operation, the description of a good nurse, and the details of arranging for an operation, are simply and concisely stated. In comparison, the thorough purge, shaving of the pubes, and preliminary starvation, often insisted upon, seem excessive. The

author's great dread of chilling the surface of the patient's body is exemplified in the manner in which he would wrap her in a shawl before making the incision. The author's practice in making the incision, in dealing with adhesions, in the toilet of the peritoneum, in the use of drainage, in closing the wound, dressings, and the use of antiseptics, fully includes the essentials of good abdominal surgery wherever practised.

In after-treatment, the author allows water in moderation; uses tartrate of morphia in doses from one-twelfth to one-quarter of a grain, gives castor oil or salines by the mouth, and in threatened paresis of the in testine injects quinine and whiskey, or passes the rectal tube. We miss the free use of strychnia hypodermatically so common among American operators. We also note the agreeable absence of that hysterical denunciation of morphia which has been so industriously used by extremists to attract attention to themselves and their fads. In peritonitis the author's pathology dictates treatment, as should be the case with all surgeons. Warmth, morphia and salines, local gastric treatment, are first to be tried; for rigor and collapse, immediate opening and free flushing. Here again the older pathology and experience may seem to run counter to modern teaching and practice: it is for the individual operator to study the individual case, do what he believes best, and bear the responsibility. In chronic peritonitis, usually tubercular, tapping or aspiration, with iodine and the iodides, will usually suffice. Drainage should be by rubber tubes; the gauze drain is not recommended.

Ventral hernia is rare in the author's observation, resulting from imperfect union through bad technique; the rubber drain does not cause it, others may. Abscess is treated by poultices, and incision with drainage. Complicated methods of closing an abdominal wound are unnecessary; interrupted stitches through all tissue, three to the inch, of silk, are used. After the operation a stout jean belt is worn next the skin; the belt should be kept from slipping up by fastening the stockings to it by suspenders at the sides.

Rare forms of disease of the peritoneum and the stomach are treated fully and clearly in accordance with the principles of sound surgery and ripe experience.

In diseased conditions of the intestine calling for surgical care, every effort must be made to arrive at a correct diagnosis. When such is reached and the condition requires operation, no time must be lost, but an immediate operation is imperative. The condition of the pulse in intestinal obstruction is of great importance. Obstruction in the intestine due to nervous exhaustion is a condition of great importance not always recognized, but requiring most skilful care. Should the abdomen be opened, and only such a condition be found, the intestine should not be opened, but brought to recover its tone through proper non-operative treatment. In cases of injury to the intestine operation should be promptly performed, if it is to be of service to the patient.

The author divides appendicitis, for purposes of treatment, into those cases in which rupture of the appendix has not occurred, those in which it has happened, and chronically relapsing cases. For the first, opium, castor oil, poultices, fomentations, rest in bed, and guarded diet are advised. Operation is needed so soon as symptoms of rupture occur, or when the patient has relapses. Drainage with rubber tubes is practised; aspiration of an abscess of the appendix is never permissible. The sur-

gery of the liver, kidney, and spleen, is treated of in the same clear and thorough manner which characterizes the entire book.

In the section devoted to gynecology an earnest plea is entered for careful diagnosis, and especially in conditions suggesting cœliotomy. The most significant symptom of ovarian tumor is the emaciation of the chest and arms in proportion to the rest of the body. In ovarian growths complicating pregnancy, a peculiar feeling of want of definition presented by the tumor is very significant. In ovarian tumors which suppurate, a simple chill is given as one of the causes of this complication. The prognosis of ovariotomy is given as 5 per cent. mortality at the outside. The presence of adhesions, extensive stripping up of the broad ligaments, and weakness of the heart are the conditions which weigh most against a successful result; the prognosis in suppurating ovarian tumors is favorable. In pregnancy and ovarian tumors, operation in the early months, and, if the tumor does not obstruct birth, palliation until after labor, are advised; where an ovarian tumor complicates labor, aspiration or removal is indicated.

Ovarian cysts should never be emptied except by aspiration, and then complete aspiration is imperative. The practice of removing a small portion of fluid for examination is most dangerous. In treating the pedicle after ovariotomy, the pedicle never bleeds after the use of the cautery, but the greater delicacy requisite for the successful use of the cautery makes the ligature more popular. Cysts of the broad ligament may be successfully treated by tapping.

Removal of the ovaries is not justifiable in uterine dysmenorrhœa, when the patient is simply neurotic and no actual disease can be found in the pelvis. Salpingitis may follow simple chill during menstruation, which will rarely be assented to by many. If pus be present, operation is imperative; if not, rest in bed, hot packs, counter-irritation, iodine, and hot douches are indicated. We miss here the treatment of endometritis, and consequent salpingitis, by dilating, curetting, and antisepticizing the uterus, which gives such good results in our hands. Apostoli's use of electricity has found favor and has been followed by cessation of pain at the menstrual epochs.

In the treatment of fibroid tumors of the uterus the writer's opinions are certainly entitled to full consideration. It is one thing for a man who is incompetent to perform hysterectomy to inveigh against modern gynecological surgery, and advise electricity and palliation, but quite another for one skilled in abdominal surgery to state unreservedly that all fibroids do not warrant hysterectomy, and that electricity will sometimes cure the disability caused by fibroids, while other methods of palliative treatment will avoid an operation. The grounds for the adoption of the various methods of treatment are fully stated, and the natural history of fibroids is taken as a rational basis for judgment. In performing hysterectomy, "The operation should always be begun with the intention of performing the intra-peritoneal method, and removing the whole organ if possible, but the operator must be prepared to adopt any method, should it seem best to do so when the exact conditions are found out during the progress of the operation." We quote this paragraph entire as affording the best possible summary upon the question of technique in hysterectomy. Péan's treatment of fibroids by *morcellement* does not meet with favor; vaginal and abdominal myomectomy are not mentioned. The section upon fibroids, in this book, and Lusk's paper on the subject (THE

American Journal of the Medical Sciences, July, 1894), contain the best statement of our actual knowledge of this subject known to us.

Cancer of the uterus; extra-uterine pregnancy; hysterectomy for prolapse; the abdominal surgery of difficult labor, including symphysiotomy, and pelvic abscess, are next considered. In pelvic abscess drainage is advised, through the dependent part, *per vaginam*, if possible. An account of heart-clot closes the volume. We are surprised to know that of five cases in Dr. Keith's experience but two have proved fatal.

In concluding our review of this book we draw attention with pleasure to the thorough scholarship and good judgment of its author. It may be styled conservative by some, but it certainly is a safer guide than are the writings of those with more courage than conviction and more conviction than judgment. If it does not present an extensive comparison of the methods of operators outside of England, it states clearly and fairly the well-tried methods of those to whom abdominal surgery owes much. The account of illustrative cases which the volume contains is not the least valuable of its contents. E. P. D.

Leçons de Thérapeutique. Les Agents physiques et naturels. Par Georges Hayem, Professeur de Clinique Médicale à la Faculté de Médecine de Paris; Médecin de l'Hôpital Saint-Antoine; Member de l'Académie de Médecine. Pp. viii., 692. Paris: G. Masson, 1894.

[Lectures on Therapeutics. Physical and Natural Agents. By Prof. Georges Hayem, etc.]

The third and fourth volumes of the *Lectures on Therapeutics* belonging to the series of which this is the fifth, have already been reviewed in The Journal. This section, devoted to thermal agents, covers one hundred and twenty-seven pages. Commencing with general remarks concerning their action on circulation, nervous energy, and temperature, the author takes up the effects of cold applications, which he classifies as local, distant, secondary (reactions), or late; following the same order, warm applications are discussed. Then follows a description of the various procedures, both for cold and warm applications, baths of various kinds, affusions, lotions, packs, and the variations which have figured so extensively in the literature of the past fifty years. The Scotch douche, Russian, Roman or Turkish baths are not neglected. This portion of the work closes with a well-written summary of the effects, indications, and contra-indications of this method of treatment. The matter, as here presented, is more fairly set forth, based upon a more exact physiology and with less exaggeration as to expected results than is to be found in the *ex parte* arguments of many little books which reviewers are, without knowledge of existing literature, likely to commend. This portion of the book is safe for the practitioner, who wishes to do his whole duty to his *clientèle*, to follow; and this cannot be truly said of considerable of the recent hydrotherapathic literature.

Two hundred and eighty pages are devoted to the subject of electricity. The physics of this agent are presented well within the comprehension of the professional reader, the terms in use clearly defined, and the various apparatus fully described and illustrated. We believe,

however, that static electricity should have received more attention, and we do not find the more recent machines figured nor the recent and important improvements noted. So far as galvanism and faradism are concerned, the multiplicity of apparatus and the full descriptions leave nothing to be desired. Their number, however, suggests—what the practitioner already knows from experience—that the perfect galvanic or faradic apparatus has not yet been devised. Storage-batteries receive attention, and the statements made are discreet, ending with the observation that "in general they are furnished by the manufacturers, who keep them in order by contract." The therapeutic results are accurately and justly set forth, and the more recent methods and theories, including the sinusoidal currents and electric cataphoresis, fully explained. We believe, however, that metallic electrolysis is omitted. Starting upon a chemical and physiological basis, electricity can accomplish certain definite and constant results; it is not a panacea, nor is it even a remedy to be used otherwise than in accurate dosage, under well-defined indications, and to accomplish accurately limited purposes. From this standpoint we believe the section is practical, sound in theory, and worthy of careful study.

Atmospheric pressure receives brief mention in thirty pages. The physiology of compressed and rarefied air, the therapeutic ends and results, are rapidly sketched. Although Bert's cabinet and Walderburg's apparatus are figured, the author is apparently unaware of the practical work that has been done in this country with the pneumatic cabinet—formerly more in use than at the present time. Climate receives due attention in seventy-four pages. Of necessity this subject is rapidly gone over; the analysis of what goes to make up the totality known as climate, the classification of stations and distinctive characteristics of various stations, are briefly stated—for a full exposition of this subject would occupy a much larger volume than this.

The remainder of the volume is devoted to mineral waters. The author has very skilfully avoided undue enthusiasm, which might readily be acquired from the highly-colored literature of the resident physicians of the various spas, and he has given the subject careful study. The classification is a practical one, and the statements regarding the properties of the various springs carefully made and presented. We would criticise this and the subject-matter of climates only in that, with a few insignificant exceptions, the health resorts and mineral springs of the Western hemisphere are entirely omitted, thus markedly limiting the usefulness of the book for American readers. A colored map showing the climatic stations, mineral springs, and bathing resorts in France and central Europe is a very important addition to the volume.

The book is well made, and mechanically leaves little to be desired. The illustrations, however, on pages 101 and 103 suggest the "living pictures" of the stage of to-day. Apostoli deserves better than to be designated as Aposloli (p. 402). Also, on page 624 the analysis of Rubinat Condal is omitted. We approve of the grouping together of these subjects in one volume; they are thus presented in truer perspective, their values more justly appear, and there is less opportunity for unwarranted enthusiasm concerning individual methods and ignoring other means for the accomplishment of definite purposes.

This is an attractive and readable book; we wish that it were accessible to the English reader. We hope the day is not far distant when

our medical students may be fortunate enough to know these subjects as thoroughly as at present they are taught the uses of drugs. When that day arrives the material on these subjects that is now placed before the medical public as alleged contributions to literature will not find a market. R. W. W.

PAIN, PLEASURE, AND ÆSTHETICS. An Essay concerning the Psychology of Pain and Pleasure, with special reference to Æsthetics. By HENRY RUTGERS MARSHALL, M.A. London and New York: Macmillan & Co., 1894.

THIS is a work in pure psychology. It seems to be dialectical rather than scientific; to be founded upon subjective rather than objective study. This is, perhaps, the inevitable characteristic of purely psychological work: its method is largely introspective, with self-consciousness as its agent. This tends strongly to make dry reading, especially for workers in other fields of science who are accustomed to strictly objective methods, and whose labors appeal to all, or to most all, of the special senses. This subjective character is strongly marked in Mr. Marshall's book, in which there is little reference to facts of original observation, and an almost total absence of illustration from either Nature or literature. Hence the book makes unmistakably hard reading, and the profits to the ordinary reader are few. It has not been always so with the psychologist; we recall the works of Locke, of Dugald Stewart and of Sir William Hamilton, in the style of all of whom there was a vitality and an aptness of illustration which are no longer cultivated.

We consider it of the first importance that psychology should be submitted as strictly as may be to the ordinary methods of science, because it is one of the chief of the sciences, and especially because it has important relations with some of the medical sciences.

Mr. Marshall's book does not present psychology in any of its relations with the medical sciences, but in its relations with æsthetics and the art instincts. In this aspect of the book it is not our part to review it extensively here. In his analysis of pain, the author refers to the work already done in psycho-physics, but he is not inclined to adopt the view that there are special nerves and paths for pain in the nervous system. His conception, in fact, of what constitute pleasure and pain is clothed in language which does not convey to our mind a clear meaning. He is an advocate of the so-called Quale theory, which teaches that pleasure and pain shade into each other, and that one or other, or both, of them are qualities of all mental states. This view is opposed, we believe, by the physiological psychologists, who teach that pain at least is a distinct sensation, with its own special nerve-tracts and sense-terminals, and who adduce facts from pathology to support their claim.

The book is addressed primarily to the psychologist, and secondarily to the artist; but the latter, as Mr. Marshall says rather deprecatingly in the introduction, "at the mere mention of psychology will be apt to lay the book aside," in which opinion we agree with the author, because we believe that art impulses cannot be nourished in books of pure psychology and abstract phraseology. J. H. L.

PROGRESS

OF

MEDICAL SCIENCE.

THERAPEUTICS.

UNDER THE CHARGE OF

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The Treatment of Dysmenorrhœa.

Dr. Schwarze speaks with emphasis against the use of narcotics. Viburnum prunifolium, fluid extract, in teaspoonful doses thrice daily for from five to seven days before, and continued during the menstruation, gives excellent results without unpleasant after-effects. It is not so successful if an inflammatory condition is associated with this symptom. He has noted, also, its value in arresting threatened abortion, even after the dilatation of the os uteri has been established. In many cases local massage is of great value, but it should only be employed in those which are not erotic. The use of a uterine sound before menstruation is frequently followed by relief, and of still more value is dilatation of the entire cervical and uterine canal. Electricity—galvanic current, aluminium negative pole in the uterus, large positive pole upon the abdomen, current of from fifty to sixty milliampères—has been of service in many cases. Castration is not indicated from the standpoint of the gynecologist alone, but only after consultation with the neurologist and alienist.—*Therapeutische Monatshefte*, 1894, Heft 5, S. 191.

Pilocarpine in Erysipelas.

Dr. G. Walker Barr administers hypodermatically a dose sufficient to produce a marked physiological effect, and repeats it in two hours, a second time in six, and for the third time in two hours. One-sixth of a grain in the beginning is usually sufficient to cause salivation and sweating.—*Therapeutic Gazette*, 1894, No. 5, p. 289.

Sodium Nitrite as a Therapeutic Agent.

Mr. Gordon Sharp prefers the sodium to the other nitrites, since it is more stable than the amyl and ethyl nitrites, and believes that the dose

should be from one to four grains; if any benefit is to be obtained it will be from the latter dose. The disagreeable symptoms—nausea, vomiting, syncope, and headache—which may arise during the administration of the drug are relieved if a primary sedative and stimulant are given: fifteen minims of aromatic spirits of ammonia, one or two minims of tincture of capsicum, five minims of a solution of morphine hydrochlorate, and chloroform water to one-half fluidounce. In angina pectoris, small doses which keep the bloodvessels in a slight state of relaxation give the best results. Large doses may so much reduce the blood-pressure that the heart, already weak, is unable to accommodate itself to the suddenly altered conditions, and syncope may take place. In irregular heart action relief follows in many cases. The explanation may be that some poison circulating in the blood causes a contraction of the bloodvessels of the periphery. Theoretically, paroxysmal bronchitic asthma should be benefited, yet so far as the evidence in six cases goes, this is not the case. In neurotic asthma the remedy failed, and in subacute bronchitis it is difficult to say if the drug had any effect. Graves' disease appears to be aggravated by it.—*Practitioner*, 1894, No. 311, p. 345.

Local Applications of Guaiacol.

M. Ferrand reports at the *Société Médicale des Hôpitaux* that in order to use this remedy as a local analgesic over large areas, without irritating the skin, it should have added to it an equal part of glycerin and be covered with tissue to prevent evaporation. The analgesia commences at once, and is established in a few hours; should pain return, it can be relieved by renewed applications. On the other hand, in order to obtain anti-thermic effects, it is necessary to use the drug pure or almost pure; in each case in a vehicle which can be absorbed by the skin.—*Revue de Thérapeutique Medico-Chirurgicale*, 1894, No. 10, p. 267.

The Hypodermatic Use of Mercurials in Syphilis.

Dr. L. Wolff, from an extensive correspondence, finds that: 1. This method of using mercurials is largely employed in the treatment of syphilis, with probably the exception of France. 2. The order of preference is for sublimate, next calomel, then the salicylate, yellow oxide, and gray oil. 3. The soluble are preferred to the insoluble preparations. 4. Calomel holds the first place as to rapidity of action and permanence of effect. 5. The duration of treatment should be determined by the complete disappearance of symptoms. 6. Serious complications may be avoided by proper care and cleanliness. 7. The hypodermatic method is established upon a firm basis. 8. With the exception mentioned above, the hypodermatic injection has to a great extent superseded the oral administration of mercurials.

Dr. Orville Horwitz has made a clinical study of the hypodermatic method of administering corrosive sublimate and gray oil. He concludes that: 1. Hypodermatic medication will not abort the disease. 2. It should not be employed as a routine method. 3. The production of abscesses and ptyalism must be rare. 4. Injections of corrosive sublimate give rise to trifling pain, but not to callosities. 5. The gray oil gives rise to slight pain and always produces induration. 6. The gray oil is more dangerous than

corrosive sublimate. 7. In suitable cases, when properly employed, these remedies are among the strongest weapons wherewith to fight the disease. 8. One-quarter of a grain of corrosive sublimate should be administered in each injection; if mercurials have already been employed, one-sixth of a grain. 9. Corrosive sublimate is of undoubted value in lesions of the face, and when a rapid impression is desired; likewise when important structures, as the brain or eye, are attacked. The hypodermatic treatment is a substitute for inunction, of advantage when time is an object; in relapsing syphilis; in disease of the nervous system; in rebellious eruptions. 10. The gray oil should be employed in severe secondary syphilis when there is evidence of a tendency to relapse; in nervous syphilis it is far superior to inunctions. 11. This treatment is the most reliable and active that can be employed.—*The Therapeutic Gazette*, 1894, No. 5, p. 309.

Anæsthesia by Ethyl Bromide.

Dr. Ch. Eloy carefully reviews this subject. Anæsthesia takes place in two stages: the first partial—consciousness is not lost; the second, consciousness is lost. It is an anæsthetic at once powerful and rapid. It cannot be employed for long operations nor when there is likely to be a great loss of blood, for the drug will increase it. Clinically it is contra-indicated in pulmonary tuberculosis, acute or chronic bronchitis, pulmonary emphysema, cardiac affections, severe anæmia, hysteria, and alcoholism. It is employed in the same way as is chloroform. It is the anæsthetic of choice for short operations, but it cannot replace chloroform. If used with chloroform (mixed anæsthesia), it shortens the pre-anæsthetic stage, and is the method of choice in large operations.—*Journal des Praticiens*, 1894, No. 35, p. 412.

[When this anæsthetic was employed in this country, some fourteen years ago, it was found to be dangerous, even causing death, so that its use was abandoned.—R. W. W.]

The Physiological Actions of Alcohol.

Dr. David Cerna concludes a most interesting paper as follows: 1. Alcohol in small amounts excites and in large doses depresses both the peripheral motor and sensory nerves. 2. Excessive quantities cause a spiral degeneration of the axis cylinder of nerve fibres. 3. Reflex action is at first increased and afterward diminished by an influence exerted upon the spinal cord and the nerves. 4. In small amounts the drug stimulates the cerebral functions; it afterward, especially in large quantities, depresses and finally abolishes them. 5. Alcohol causes a lack of co-ordination by depressing both the brain and spinal cord. 6. In toxic doses alcohol produces hyperæmia of both brain and spinal cord, especially of the lumbar enlargement of the latter. 7. Small doses of alcohol produce increased rapidity of the heart-beat; large amounts, a depression of the same. In either case the effect is brought about mainly through a direct cardiac action. 8. The drug in small quantities causes a rise of the arterial pressure by a direct action upon the heart; in large amounts it depresses the arterial pressure similarly through a cardiac influence. 9. In large doses alcohol enhances coagulation of the blood; in toxic quantities it destroys the ozonizing power of this fluid, causing a sepa-

ration of the hæmoglobin from the corpuscles. 10. Alcohol in small doses has little or no effect upon the respiratory functions; in large amounts it produces a depression of both rate and depth of the respiration through a direct action upon the centres in the medulla oblongata. 11. The drug kills by failure of the respiration. 12. On the elimination of carbon dioxide alcohol exercises a varying action, sometimes increasing, sometimes decreasing such elimination. 13. The action of alcohol on the amount of oxygen absorbed also varies, and may be said to be practically unknown. 14. The drug lessens the excretion of tissue-waste, both in health and disease. 15. In small amounts alcohol increases bodily temperature; in large doses it diminishes the same. The fall of bodily temperature is mainly due to an excess of heat-dissipation caused by the drug. 16. Alcohol, in sufficiently large amounts, has a decided antipyretic action. 17. In moderate amounts alcohol aids the digestive processes. 18. Alcohol diminishes the absorption of fats. 19. The drug exercises a varying influence on the amount of urine secreted, but it probably increases the activity of the kidneys. 20. In large doses, or when continuously used for a long time, alcohol produces cirrhotic changes, especially of hepatic tissue, and paralysis of spinal origin. It also causes insanity, epilepsy, and other maladies. 21. Alcohol is mainly burnt up in the system, when taken in moderate quantities, but when ingested in excessive amounts it is partly eliminated by the breath, the kidneys, and the intestines. 22. Alcohol is a conservator of tissue, a generator of vital force and may, therefore, be considered as a food.—*Therapeutic Gazette*, 1894, No. 6, p. 371.

The Glycero-phosphates.

M. A. Robin has been led to use these remedies because, in his studies upon neurasthenia, he had noted that certain patients eliminated in the urine considerable quantities of incompletely oxidized phosphorus, indicating an exaggerated denutrition of the nervous lecithin. It is well known that the greater portion of the unoxidized phosphorus is found in the urine as phosphoric acid, and that this is one of the constituents of lecithin. Since, then the elimination of medicinal phosphates is accomplished with great difficulty, it is believed that phosphorus is furnished to the organism in an organic combination which approaches that which obtains in the nervous system. Marvellous results are obtained, and these especially upon the apparatus of innervation. The calcium, sodium, and potassium glycero-phosphates are used, either singly or combined, administered by the mouth or subcutaneously. The lime salt in a four-grain dose given subcutaneously will increase the urea, the chlorides, sulphates, lime, magnesium and potassium, the coefficients of nitrogen and sulphur oxidation. It does not appear to have a marked influence upon the uric acid, and only causes slight variations in the amount of incompletely oxidized phosphorus, which it tends rather to diminish. It has a powerful influence in accelerating nutrition, and this acceleration has its source in the especial stimulation of the nervous apparatus. In this respect its action is entirely antagonistic to that of antipyrine, which is the remedy for exaggerated nervous excitability, as the glycero-phosphates are indicated for nervous depression. They have been successful in the convalescence from epidemic influenza and infectious diseases, the nervous asthenia

of various origins, in a particular variety of neurasthenia dependent upon a loss in the urine of incompletely oxidized phosphorus, in sluggish chlorosis, when the nitrogen is incompletely oxidized in the phosphaturic albuminurias, and in phosphaturia. In conclusion: 1. The glycero-phosphates are powerful therapeutic agents which accelerate general nutrition through their action upon the nervous system. 2. The essential indication for their use is nervous depression. 3. In subcutaneous injection they produce at least as energetic effects as the testicular liquid, which probably acts only by virtue of the organic phosphate which it contains. There are advantages in using these in place of the liquid, in that definite products of regulated dosage are substituted for an uncertain preparation, which is variable and eminently unstable. 4. The observations above cited give the hope that these injections will be useful in the treatment of nervous asthenia from various causes, of phosphaturic albuminurias, of phosphaturias, of Addison's disease, of some sciaticas, and tic douloureux of the face. In locomotor ataxia the results are more uncertain, but appear to tend toward a diminution of the lightning pains.—*Les Nouveaux Remèdes*, 1894, No. 9, p. 203.

Legumin for Intolerance of Milk Diet.

Dr. Boret, recognizing the very great usefulness of a milk diet in various conditions, believes that, owing to its contained lactic acid, it possesses a microbicidal power; it has been demonstrated that this acid is a bad soil for the growth of the bacillus coli communis. Certain individuals, however, are as intolerant of milk as others are of wine or alcohol. Some have a repugnance which can be overcome, others have an incompatibility due to their pathological condition. Even if the digestibility of milk is established in a certain case, inappetence or even disgust may render this treatment unavailing. Sometimes an actual indigestion can be remedied by the addition of alkalies, as sodium bicarbonate or phosphate, or the administration of vegetable or mineral acids before or after the meal. Even under these conditions the milk may not be borne, and then it becomes necessary to resort to some of the mixed natural diastases, of which legumin is the best type. Four cases are cited where this substance was used in daily dosage of one and one-half ounces. Even six ounces can be dissolved in a quart of milk. Legumin is certainly a eupeptic, and at the same time it is a food, because of the albuminoids and phosphates which it contains.—*Bulletin général de Therapeutique*, 1894, 20e livr., p. 466.

Antispasmin.

Dr. S. Rabow states that this drug consists of a union of one molecule of sodium narceïne with three of sodium salicylate, $C_{23}H_{26}NO_8Na + 3\,C_6H_4(OH).CO_2Na$. It occurs as a whitish, slightly hygroscopic powder of an alkaline reaction, easily soluble in water, giving a pale-yellow solution. It contains about 50 per cent. of narceïne. Narceïne is contained in opium in from 0.1 to 0.4 per cent., and was shown by Bernard to have a purely hypnotic action and to be only slightly poisonous. The remedy has been found to possess decided hypnotic properties and to be a sedative in painful affections, particularly in those where spasm is associated with pain. In whooping-

cough, in from one-sixth to one and one-half grain doses good results have been obtained. For adults, three to seven grains; generally the smaller quantity is sufficient for obtaining the hypnotic effects. It may be administered in brandy, peppermint water, glycerin, or bitter-almond water, or, if desired, hypodermatically. It appears to rapidly lose its effect when administered to adults. In general it may be said to possess the properties of morphine, but in less degree, it being forty to fifty times weaker. In children's practice it may be useful, since no unpleasant after-effects have been noted.—*Therapeutische Monatshefte*, 1894, Heft 5, S. 217.

The Dangers of Chloralose.

M. Touvenaint reports two cases: 1. A diabetic received at night about three and one-half grains; he immediately slept, but awakened in two hours for urination. He was as if intoxicated, dull, and moved with difficulty. Fifteen minutes afterward he took the same dose. About 3 o'clock in the morning he awoke, the prey of terrifying malaise, general trembling, deafness, incoherent language, nausea, deglutition impossible, and later marked dilatation of the pupils, pulse feeble and slow, involuntary evacuation of bladder and bowels. Clysters of black coffee, ether, sinapisms, and stimulating frictions were rendered necessary to combat his symptoms. 2. The insomnia and pain caused by a uterine fibroma was treated by the same amount of chloralose as above stated, taken in two doses. Precisely the same symptoms supervened, and in addition vomiting. It is noteworthy that the dose given in these cases did not exceed the mean dose recommended by the authors who have extolled the remedy.—*Revue de Thérapeutique Médico-Chirurgicale*, 1894, No. 11, p. 296.

Internal Mucous Membrane Massage.

Dr. Carl Laker believes that the result of direct massage is not only upon the cells themselves but as well upon the deeper layers of the tissues. Through the vibration of the separate tissue elements is brought about a regeneration, and this goes on to a complete new-building of the mucous membrane. Obvious results are those obtained on palpation and rhino- and laryngoscopic examinations, as shown by changed color, volume, and consistence of the tissues. For this method of treatment the hand is superior to all instruments, no matter how well constructed. To the objection that it is tiresome to the physician, it is stated that as many as thirty separate sittings can be given in the course of the afternoon without fatigue. This method is useful in hypertrophic nasal catarrh, especially in cases where reflex symptoms are noted, asthma, neuralgia, and headache. After this treatment relapses are less frequent, and, when they occur, are more readily controlled. In acute middle-ear disease, not only to open the Eustachian tubes but to keep them open, massage has proved itself an excellent remedy. In general, this method of treatment should be carried out as far as is possible in the various diseases of the upper air-passages, and it will frequently succeed in producing improvement and even cure when other methods, even in practised hands, have failed.—*Wiener medizinische Presse*, 1894, No. 24, S. 926.

MEDICINE.

UNDER THE CHARGE OF

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A Case of Probable Hereditary Lead-palsy.

ANKER (*Berliner klin. Wochenschrift*, 1894, No. 25, p. 577) has reported the case of a girl, eight years old, who for a year had presented progressive weakness, followed by palsy of both lower extremities. The father of the child had been a compositor for seventeen years, and had at various times suffered with lead-colic; syphilis was denied. The mother had had three abortions. At the age of three years the child had fallen and struck the back of its head; consciousness was lost for five minutes, and vomiting followed. From this time the intelligence was noticed to fail. The child presented a demented look; she could not give her name and age, and could not do simple things that she was told to do. The head was dolichocephalic, and the muscles of the face presented fibrillary twitching, particularly upon the left side. The appearance was anæmic. The feet were in a position of equino-varus. There was some stiffness in the knee-joints, and the knee-jerks were exaggerated; patellar clonus could be elicited. The response of the Achilles tendon was preserved, but not exaggerated. Of the extensors of the right foot and the toes, only the tibialis anticus and the extensor hallucis longus were slightly active; while plantar flexion of the foot and toes was preserved. The toes of the left foot could only be slightly extended, but the tibialis anticus could be actively contracted; abduction of the foot was entirely wanting and plantar flexion was normal. The plantar reflexes could be elicited only to a degree permitted by active movement. The muscles in the distribution of the peroneal nerves presented partial reaction of degeneration. The mental condition of the child excluded a satisfactory study of sensibility, although simple touch and pin-point appeared to be perceived. The tendon reflexes were exaggerated in the upper extremities. The mobility of the arms was normal. Speech was somewhat nasal. The ocular movements were preserved, and the pupils reacted normally; ophthalmoscopic examination disclosed no lesion. The teeth were in good condition; the gums presented no blue line. There was evidence of weakness of the vesical sphincter. Spontaneous pain in the extremities had not been noted. In the course of the

succeeding six months the palsy also invaded the upper extremities. The hands assumed the position characteristic of radial palsy, hanging in a flexed position; extension was impossible. The thumb was flexed and adducted; abduction and hyperextension were wanting. The triceps was intact; the supinator longus contracted in flexion of the forearm. Muscular irritability was preserved, although tardy, in the extensors of the hand. Reaction of degeneration was present in the extensor communis digitorum, extensor carpi ulnaris, extensor carpi radialis longior, extensor ossis metacarpi pollicis, extensor secundi internodii pollicis, and extensor primi internodii pollicis. The interossei were paretic; the first was paralyzed, and presented reaction of degeneration. The muscles of the thenar eminence presented a similar condition. The palsied muscles were greatly atrophied. The lower extremities now hung in a relaxed condition. The function of the tibialis anticus, as well as plantar flexion of the toes, was entirely lost. The knee-jerks and the response of the Achilles tendon were preserved. After the lapse of an additional four months the paralysis of the right hand had somewhat receded; extension of the proximal phalanges was normal; the hand could be extended at the wrist, and the forearm flexed at the elbow; abduction and adduction of the fingers were preserved. In the left upper extremity the radial distribution was free, although a typical claw-hand was present; the paralysis of the interossei was, however, not complete; the opponens pollicis performed its functions normally. The peroneal palsy was unchanged; plantar flexion was preserved. The paralyzed muscles presented reaction of degeneration. Careful examination of the urine failed to disclose any abnormality. At first it was thought that there existed specific cerebro-spinal disease, but subsequently the peculiar involvement of the muscles supplied by the radial nerves, and the escape of the triceps and the supinators, suggested a plumbic origin, and inquiry revealed the fact that the father had been a compositor for many years. Direct intoxication with lead, however, did not seem possible, as the man did no work at home; and the conclusion is reached that the case is probably one of an hereditary form of lead-palsy. The condition had to be diagnosticated from peripheral neuritis, poliomyelitis, and amyotrophic lateral sclerosis.

Bulbar Palsy and Motor Aphasia in the Sequence of Influenza.

Stembo (*St. Petersburger medicinische Wochenschrift*, 1894, No. 19, pp. 171, 172) reports two cases that aptly illustrate the multiformity of the complications of influenza, and particularly those involving the nervous system. In the one case speech became difficult, fluids taken into the mouth returned through the nostrils, saliva accumulated in the mouth, and there was dysphagia. Movements of the lips were interfered with, and the enunciation of the labials was imperfect. The tongue when protruded was tremulous, appeared small, and presented longitudinal furrows. The linguals were enunciated indistinctly. The uvula was deflected to the right. The constrictor of the pharynx was paretic, so that deglutition was difficult. The posterior crico-arytenoid muscle of the left side was paralyzed, and the corresponding vocal band assumed the median position. The voice was hoarse and nasal. The electric irritability of the muscles generally was normal; that of the

affected muscles was diminished; in these also the muscular irritability was heightened.

The second case was observed in conjunction with KOHAN, and occurred in a woman in the eighth month of pregnancy. Some time after an attack of influenza, weakness was noted in the right upper extremity, with inability to speak, although the patient heard and understood what was said to her. The face was distorted, the mouth being drawn to the left. The protruded tongue deviated to the right and the uvula to the left. The voice was hoarse, and on laryngological examination an ulcer was found in the inter-arytenoid space, together with paralysis of the left vocal band. Sensibility was obtunded on the right side of the face and in the right upper extremity, but elsewhere was normal. The tendon reflexes were somewhat increased, the cutaneous reflexes normal. The heart-sounds were normal. The patient at first could not write nor repeat what was said to her, but understood written and printed language. By and by the power of speech gradually returned, and the motor symptoms likewise improved.

In the first case the bulbar lesion is presumed to have been due to an influence of the toxines engendered in the course of influenza, while in the second it is surmised that a hemorrhage took place into the lower portion of the ascending frontal convolution, while the laryngeal symptoms are ascribed to the local lesion.

AN EPIDEMIC OF MILIARIA.

SCHAFFER (*Wiener med. Blätter*, 1893, No. 32; *Provincial Med. Journ.*, vol. xiii., No. 146, p. 101) reports the occurrence of an epidemic of miliaria occurring in an Austrian province in the spring of the year, and lasting for nearly three months. Of the 5079 persons forming the total population of the district, 159 were attacked as follows: 17 men, 14 women, 128 children; though there is reason to believe that many mild cases escaped observation and notification. As a rule, premonitory symptoms, such as a sense of heaviness in the head, giddiness, and very considerable injection of the conjunctivæ, lasting for one or two days, preceded the rigors and outbreak of the characteristic exanthem, the latter generally appearing first on the body and spreading afterward to the extremities, and occasionally to the head itself. It consisted of numerous distinct red spots, each having a miliary papule (never a vesicle) in the centre. The eruption faded away in the course of a few hours, to be followed by intense itching and profuse sweating, but the papules could often be seen as late as the third day. Fever was rarely present during the *stadium floritionis*, which lasted from one to three days, and was followed by furfuraceous desquamation, which was usually terminated by the eighth day. The disease seldom lasted longer than fourteen days; its period of incubation is from eight to fourteen days; the same individual may be attacked more than once. In the epidemic in question no death occurred and complications were rare, but some patients, more especially adults, were long weak on their feet and exhibited a tendency to outbreaks of profuse sweating. Neither scarlatina nor varicella affords protection against miliaria; it was, however, observed that those persons that had been attacked with boils—a complaint that had been very prevalent during the preceding winter—escaped the epidemic of miliaria.

Polyuria in Chronic Pulmonary Tuberculosis.

Robin has carefully studied the urine in a large number of cases of chronic pulmonary tuberculosis. He concludes (*Archives gênerales de Médecine*, June 1894, tome clxxiii., No. 6, p. 653) that in general the quantity of urine is slightly increased during the first stages of chronic pulmonary tuberculosis; it is about normal in the second stage, and more frequently diminished in the third stage. In each stage, however, a certain number (20 per cent.) of patients depart from the rule, and exhibit polyuria more or less marked. Polyuria is relatively more frequent in young adults than in the aged. The polyuria of the first stage of phthisis may present the characteristics of phosphaturia, or there may be simply an increase of urinary water without notably heightened excretion of other constituents of normal urine. Exaggerated azoturia due to denutrition is very rare. Polyuria of the later stages of phthisis is usually related with "mixed nephritis," tuberculous nephritis, or amyloid degeneration of the kidneys. Phosphaturia and essential polyuria seem to predispose to tuberculosis. There is likewise, however, a veritable pre-tuberculous polyuria, sometimes phosphatic, sometimes simple, that appears to be associated with cases of renal congestion. It is distinguished from the other form by the rapid supervention of pulmonary tuberculosis, and appears to be the first manifestation of the struggle of the organism with the bacilli and their toxic products. Transitory or reactional polyuria or phosphaturia has a favorable prognostic significance, while if permanent the phenomena are of unfavorable import. Oliguria depends upon accidents and complications, fever, sweating, diarrhœa, etc. A milk diet should be employed in cases of oliguria. Rectal injections of hydrogen sulphide are highly beneficial.

The Differential Diagnosis between Pulmonary Syphilis and Pulmonary Tuberculosis.

Rendu (*Bull. Méd.*, 1894; May 20, *Internationale klin. Rundschau*, viii. Jahrg., No. 27, p. 969) at a recent clinical lecture presented a case in which the question arose as to the existence of either syphilis or tuberculosis of the lungs or of both conditions in association. The case occurred in an old woman who had long been emaciated, and was cachectic, but without fever. The symptoms present were neither well-defined nor characteristic. There was complaint of pain; of stiffness of the extremities, without noteworthy weakness or paræsthesia; of dyspnœa on exertion; and for a short time of a dry cough without expectoration. On physical examination of the lungs the respiratory and auscultatory phenomena were found normal anteriorly. Posteriorly there was found dulness on percussion over the apex of the right lung, with roughened, prolonged expiration; but elsewhere the conditions in the lungs were normal. The area of cardiac dulness was not changed; the apex-beat was normal in strength and situation. On auscultation a loud, rough, systolic murmur was heard, together with a softer and more superficial murmur. The patient, however, did not complain of any symptoms of cardiac insufficiency. The arteries were neither tortuous nor rigid. The liver was normal, and the urine contained no albumin. There was present a diffuse and characteristic syphilitic melanodermia. The nose was painful

and swollen. An iritis of two years' standing existed. There was complaint of nocturnal bone-pains and of headache. The woman gave a good family history and had herself only suffered with measles. At the age of thirty she had had a sore mouth, followed a year later by pustules that left cicatrices. For several years after this her health was poor, but subsequently her condition improved. At this time she presented symptoms of bronchial catarrh together with hæmoptysis, and also renewed symptoms of syphilis despite active anti-syphilitic medication. In a discussion of the differential diagnosis it was pointed out that against the existence of tuberculous process was the long duration of the case, the absence of expectoration (excluding a search for tubercle bacilli), of râles, and of concomitant symptoms. Although syphilis usually attacks the lower portion of the lungs, cases have been reported in which the apex has been invaded. It was further noted that syphilis and tuberculosis of the lung may occur in association, and also that tuberculosis may develop in a lung previously syphilitic. Indurating pneumonia was to be excluded by the absence of a history of an attack of acute pneumonia. It was thus probable that the pulmonary changes were syphilitic. In the absence of other etiologic factors, such as the infectious diseases and arterio-sclerosis, the same origin had also by exclusion to be ascribed to the endocardial changes. The attack of measles was not thought an adequate cause. Finally it was noted that marked improvement followed the administration of anti-syphilitic treatment, including mercury and potassium iodid.

PURULENT NECROTIC MEDIASTINITIS, WITH PERICARDITIS AND DOUBLE EMPYEMA, RESULTING FROM SUPPURATION OF A SUBMAXILLARY GLAND.

MIDDLETON (*Glasgow Medical Journal*, vol. xlii., No. 1, p. 1) has reported the case of a boy, eleven years old, who complained of pain in the front and left side of the chest. A week previously a small swelling had been observed under the lower jaw on the right side, which was supposed to have arisen from a bad tooth. A day later pain was felt in the breast, and shortly afterward a pericardial friction-sound was detected. The dyspnœa was marked, the respirations numbering 50 per minute and causing great pain. The temperature was 100.2° and the pulse 132; irregular, small, and easily compressible. The pain in the breast was described as griping, while that in the left side was stabbing in character. The recumbent posture was lying on the right side. The swelling below the lower jaw on the right side was of considerable size, extending quite down to the level of the clavicle, and was fluctuant, red and inflamed-looking. Continuous with this swelling in the neck there was marked œdematous swelling over the upper part of the thorax on both sides of the middle line, with dulness on percussion. Over this area an emphysematous crackle was on one occasion made out on pressure. Pericardial friction-sounds were made out all over the præcordial area, and in the left lateral region and back pleural friction-sounds were also heard. The temperature rose to 103° and the boy became delirious; the pulse varied from 132 to 158 and the breathing from 42 to 50 in the minute. The aspect became ashy-gray and the finger-tips livid. The dulness on percussion over

the lungs extended rapidly and the pericardial friction-sounds persisted. The condition grew progressively worse, and death ensued. When the soft tissues were reflected from the front of the neck and chest they were observed to be markedly œdematous; but there was no subcutaneous emphysema. The tissues lying in front of the trachea were thickened, opaque, and vascular, as if from the near presence of inflammatory change, and in cutting into the region of the right submaxillary gland a foul-smelling abscess was opened. Both pleural cavities contained from six to ten ounces of fetid pus, and the loose connective tissue of the mediastinum, from the suprasternal notch to the diaphragm, was infiltrated with pus and practically in a condition of slough. This sloughy condition was abundantly present on the external surface of the anterior layer of the pericardium; but the pus-infiltrated tissue could with tolerable ease be separated from the underlying pericardium. On opening the pericardium a very recent and very moderate generalized pericarditis was disclosed, sufficient to cause only a slight roughening of the surface. The right pleura presented old connective-tissue adhesions infiltrated with purulent matter. On dissecting the structures in front of the trachea a direct channel of communication was found between the submaxillary abscess and the mediastinum. No roughness or other evidence of disease of the lower jaw could be detected. The mucous membrane of the larynx and trachea was congested and covered with blood-stained mucus.

SURGERY.

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THE PRESENT POSITION OF THE OPERATION OF CASTRATION FOR HYPERTROPHY OF THE PROSTATE.

J. WILLIAM WHITE, in an address before the American Association of Genito-urinary Surgeons, gave a summary of the history and present position of the operation of castration for hypertrophy of the prostate (*Medical News*, 1894, vol. lxiv., No. 22). Dr. White instituted experiments on dogs in connection with this subject in December, 1892. In an address, given by invitation, before the American Surgical Association, on "The Surgery of the Hypertrophied Prostate," at its meeting held at Buffalo, N. Y., June 1, 1893, the results of these experiments were given, and the statement that castration might cause the hypertrophied prostate to diminish in size was advanced.

The results of the experiments in detail and the line of thought which led to these conclusions will be found in full in the *Annals of Surgery* for August, 1893, an abstract of which appeared in THE JOURNAL, 1893, vol. cvi. p. 723.

Considerable discussion in the current literature followed the publication of this article, and the following operators have reported cases: Ramm, of Christiania, reports two cases practically cured after this operation; Haynes, of Los Angeles, California, reports three cases, the first is said to be practically cured, the second much improved, and the third had been operated upon too recently to record the result; Smith, of St. Augustine, Florida, operated upon "an apparently hopeless case of hypertrophied prostate with marked sepsis, cystitis, beginning uræmia," etc. "The patient fifteen weeks after the operation had gained forty-five pounds, and had no symptoms of cystitis or other urinary trouble. He urinated freely and normally."

In January, 1894, the author operated on a medical man, aged sixty-nine years, whose prostate was about half the size of an orange, who had passed no urine except by the catheter for years, whose urine was loaded with mucus, was offensive, and at short intervals was profusely mixed with blood. Fourteen weeks later, rectal examination showed a reduction in the size of the prostate to about the normal dimensions. He had not urinated spontaneously, but while before the operation it was necessary to introduce the catheter nine and one-half inches before reaching the bladder, at the time of making the report urine began to flow when the catheter had been passed but eight inches. Furthermore, its introduction is easy and painless, instead of difficult and very painful, as it was before the operation. The urine is normal in appearance, odor, and all other respects, and no blood has appeared for two months.

INTUBATION AND TRACHEOTOMY.

VON RAUKE (*Münch. med. Wochenschr.*, 1893, No. 44; *Centralbl. für Chir.*, 1894, No. 6) has summarized the statistics of about 2500 cases of intubation that have been reported in hospital and private practice. The comparison of the results from tracheotomy and intubation in the first years of life give in the first two years better results from intubation than from tracheotomy. The proportions are, in the first year, 13.9 per cent. of recoveries by intubation, to 5.4 per cent. by tracheotomy. In the second year, 32.3 per cent. by intubation, to 25.4 per cent. by tracheotomy. There were also more intubations than tracheotomies. The author believes that the O'Dwyer tubes have proved themselves to be the best means for the purpose.

A NEW METHOD FOR THE RADICAL TREATMENT OF FEMORAL HERNIÆ.

FABRICIUS (*Centralbl. für Chir.*, 1894, No. 6) describes the following operation. An incision four to five inches long is made from the insertion of Poupart's ligament parallel to it, down through the superficial fascia, exposing the superficial epigastric vein. If the hernia passes under the lesser falciform process the sac may now be seen; if, however, it has passed beneath the superficial layer of the fascia lata, that must be cut before it is exposed. The hernia should now be reduced, the sac ligated and removed, and the stump returned into the abdomen. If the constriction is too great, Poupart's

ligament should be divided at its insertion on the inner edge of the horizontal ramus of the pubes, or, where it is possible, on Cooper's ligament. This relaxation of the ligament also permits the full exploration of the hernial canal and the removal of any lymphatic glands or tissue it may contain, and makes possible the suturing as described later.

After the crural sheath has been freed, with the contained vessels, it should be displaced outwardly over the ilio-pectineal eminence, where they should be held by a blunt hook, while Poupart's ligament is sutured to the horizontal ramus of the pubes. A sharply curved needle should be used, and the stitch should take in about three-eighths of an inch of tissue above Poupart's ligament, the horizontal portion of the pectineal fascia, the primary fascicles of the pectineal muscle and the periosteum. In inserting the first stitch next to the large vessels, care should be taken to avoid the inferior epigastric artery and vein. The ligament should be sutured from that point to the pubic spine, uniting it again to the inner border of the horizontal ramus. Care must be taken in all cases to include the periosteum. The superficial portion of the fascia lata may or may not be sutured to the pectineal fascia. To prevent inguinal hernia, the pillars of the external ring should be sutured. There is no danger of obstructing the circulation by the displacement of the artery and vein, though there may be slight œdema at first.

Resection of the Cæcum.

Sendler reports a case of resection of the cæcum, and makes the following brief observations (*Münchener medicinische Wochenschrift*, 1894, No. 1): Resections of the cæcum are rare, Sachs having been able to find but thirty cases. The chief indications for the operation are carcinoma and tuberculosis, and in a few instances on account of invagination. The case reported is that of a young woman of twenty-two years, who for some time had had intestinal obstruction. The trouble began suddenly, with severe pain in the right side of the abdomen, after having had a good night. The pain was so severe that she was obliged to return to bed. The pain continued for three weeks, but fever and vomiting were absent. Four weeks afterward there was a second attack, lasting three days. Two more similar attacks occurred, and finally a constant pain and swelling were noted in the region of the appendix.

Examination of the right iliac region revealed a distinct, firm, painful tumor. The diagnosis was extremely doubtful, inasmuch as there was no family or personal history bearing upon her condition, nor any pronounced symptoms which would lead to an opinion.

Incision was made over the most prominent part of the tumor. The cæcum was found adherent to the abdominal wall, and in attempting to free it the wall was torn, and fecal matter flowed out and was caught on the gauze. It was now clear that the whole cæcum had been transformed into a tumor, which involved the appendix, a portion of ileum and ascending colon, and continued, growing thinner, to the root of the mesentery. The tumor was removed by first excising the mesenteric portion, applying many ligatures, and suturing the mesentery at once. Intestinal clamps were then applied to the gut on each side of the diseased portion, and the growth, with the cæcum, appendix, and part of the ileum and ascending colon, removed. The ileum was im-

planted in the colon, as after pylorus resection, so that the size of the two divided ends were similar. A continued mucous suture was employed, then a sero-muscular suture of silk, and where necessary serous sutures. After removing the clamps the intestine filled immediately, so that the apposition was seen to be perfect. The abdominal wound was closed with three layers of sutures. Convalescence was uneventful; in the third week she left her bed, and four weeks after operation left the hospital. She has remained well, and the bowels are moved spontaneously and naturally.

The specimen proved to have been a carcinoma, beginning in the valve of Bauhin. Swollen mesenteric and inguinal glands were sought for but not discovered.

A Simple Method of Preventing Pressure Necrosis in Amputation Stumps.

Bogdanik (*Centralbl. für Chir.*, May 26, 1894), after a continued success, reports the following method, which was suggested by the use of the method proposed by Obalinaki. After making a short anterior and a long posterior flap, or any flap can be used, he sutures the wound by a continuous suture, and then passes a drainage-tube. Having done this he raises a fold of skin over the end of the bone running in an antero-posterior direction, and passes a chromicized catgut suture through it from within outward about three-eighths of an inch above the sawn end of the bone; the needle is passed back from without inward about three-quarters of an inch away, and after the suture is firmly drawn it is tied; in this manner a long roll is formed over the end of the bone. Since he began to use this method he has never seen any pressure gangrene. There is sometimes a granulating wound surface found over the bone after removal of the skin suture.

Appendicitis and its Complications.

Lennander (*Centralbl. für Chir.*, 1893, No. 44) reports 54 operations with 3 deaths. In 15 cases laparotomy with extirpation of the processus vermiformis was performed, in 21 cases peri- or paratyphlitic abscesses were opened. In 17 cases the appendix was removed during the period between relapses. In 1 case no vermiform appendix was found, although the cæcum could be entirely isolated. The author classifies as surgical cases: those in which are found acute diffuse peritonitis and intra-peritoneal abscesses following perforation of the appendix; all paratyphlitic cases as soon as the presence of pus is diagnosticated; also those cases in which, through slow ulceration, a perforation is produced, though the diagnosis in these cases is difficult. Medical cases he considers to be only those of appendiceal colic and all acute catarrhal processes within the appendix and that remain within it, except, perhaps, those that produce a sero-fibrinous or simple fibrinous peritonitis. In cases of chronic relapsing appendicitis, after the dangers of the operation have been detailed he would leave it to the desire of the patient, but would counsel operation if the attacks increased in frequency and severity, or if an encapsulated abscess were discovered. In regard to the technique of the operation, he advises that in all a lateral laparotomy, with the incision in the line of the motor nerves so far as possible, should be performed, in order

that subsequent herniæ may be prevented. He uses Péan's artery forceps to grasp the appendix while ligating, instead of a suture, and allows the forceps to remain when the ligation is difficult, protruding out of the wound. Physiological salt solution is used to wash out the abdomen—only a limited portion being flushed—the fluid being prevented from reaching the other portions by pressure. The excess of fluid is then drawn off by means of a glass tube, or by sponging between the separated fingers. Iodoform gauze or wick and glass drainage-tubes are used to drain and for dressings; the glass tube is emptied every three hours for the first twenty-four hours.

The Treatment of Traumatic Epilepsy.

Manteuffel (*St. Petersburger med. Woch.*, 1894, No. 4) bases his remarks upon the fact that Jacksonian epilepsy arises from an anatomical lesion of a motor area. In the beginning of the attack a small group of muscles are involved, which enables the surgeon to definitely locate the lesion on the brain surface. The treatment has usually been to remove the scar tissue in the bone and scalp, but extended no further than the dissecting up of the dura mater. The author, however, advises, with Horsley, the removal of the cortex, or if no lesion is evident the centre involved. This removal has no lasting effect in destroying the function of the part, as its labor is assumed by another portion of the brain. A relapse of the disease may come from the new scar tissue produced, but it will be after some time, and a little freedom will be of great benefit to the patient. The author believes with Kocher, that the epileptic crisis is due to a variation of pressure and circulation that produces a "commotio cerebri," or microscopic traumatism of a small portion of brain-substance, whose influence radiates out over a large area. This "commotio" may be produced by alterations in pressure in the cerebro-spinal fluid, or jarring within the brain. This is possible on account of the intense irritability of the special portion of the cortex.

The author believes that increased intracranial pressure plays a large part in the causation of this form of epilepsy. He also advised the covering of bone defects by large transplanted skin-periosteum and bone flaps, and advises operation in cases where there has been no open wound or fracture of the skull, but where the localized symptoms make it evident that a previous blow has caused a contusion of the cortical cells and left a point that is easily irritated.

Trephining in Cerebral Injuries.

A. v. Bergmann (*St. Petersburger med. Wochenschr.*, 1893, No. 51) divides cases in which trephining is demanded, as regards the time of operation, whether demanded primarily or secondarily. Among the primary he would include compound fractures where the brain is exposed or is apparently lacerated by bone-fragments. In these cases the indications are unquestioned, as are also those where there are present symptoms of acute compression or rupture of sinuses or veins. The author would also include cases in which foreign bodies are left in the wound. In gunshot wounds primary trephining is indicated where the bone-wound is extensive and bleeding persists. If, however, the ball remains within and there is no fever,

it should be left alone; secondary trephining is, however, generally called for. Secondary trephining is indicated by febrile reaction, abscesses, softening, and the formation of cysts and brain-scars. The author reports two cases of gunshot wounds and two cases of localized areas of softening, which he defines as a region of reddened, compressed brain-substance, in which is found a varying amount of extravasated blood. Its demarcation from the sound brain-substance is more or less sharply defined. He believes that the localization of such an area is an indication for operation.

OBSTETRICS.

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ICTERUS NEONATORUM.

SCHMIDT (*Archiv für Gynäkologie*, 1893, B. xlv., H. 2) has made icterus neonatorum the subject of a series of observations, especially studying the relationship between this disease and the time of section of the umbilical cord. 149 children were observed; of these 50 were separated from the umbilical cord at once, the remainder after some time, usually after placental separation. Of the latter 80, or 53.7 per cent., were icteric. 35 premature births were observed, and 114 at term. Of the mature births, 53 were icteric. Male children seemed more predisposed to the disease than female, the weak more than the strong. Whether, other things being equal, icterus interferes with the development of the child, is hard to decide, since it affects those already weak in preference.

In a large proportion of cases the disease appears between the first and fifth days. As to causation, several authors ascribe it to late section of the cord, whereby a greater mass of blood is thrown from the placenta into the child's circulation, and a great destruction of red blood-corpuscles and coloring matter ensues, followed by icterus. The uterine compression empties placental blood into the child's system. To test this view, 50 children were at once separated from the cord at birth, and 100 later; mostly after separation of the placenta. Of the 50, 36 became icteric, and 14 remained unaffected. Of the 100, 71 were observed, out of these, 30 were icteric and 41 remained well. The intensity of color and length of duration of the jaundice

were more marked in those early separated than in others. As a whole, those children whose cords were separated late became icteric in less number and intensity than those detached early.

Parturition in a Patient with Cleft Pelvis Accompanied by Ectropic Bladder.

Klein (*Archiv für Gynäkologie*, 1894, B. xliii., H. 3) reports the case of a primigravida, twenty-nine years of age. She was found to have an ectropic bladder. On account of the extreme tenderness of the parts, chloroform narcosis was required during the vaginal examination. Owing to the lack of the pubic symphysis the patient's walk was unsteady and her legs bent outward. The exposed bladder wall was inflamed and rough. The external pelvic measurements were as follows: anterior superior spines, 36 cm.; crests, 25½ cm.; trochanters, 32 cm. Baudelocque's diameter could not be taken on account of the defect in the development of the pubic bone. The child presented by the head. After the presenting part had dilated the introitus to the size of a 5-mark piece, a bilateral incision 4.5 centimetres long was made in the perineum to facilitate extraction and prevent deep rupture. After the birth of the child these were closed. The infant was not malformed, and though a little asphyxiated was readily resuscitated. On January 20th the patient was discharged, and at this time no material change in the bladder could be seen. A plastic operation was recommended later. There seemed to be no clitoris, and the nymphæ and labia were undeveloped.

The Influence of Accumulations of Urea in the Blood of the Mother upon the Uterus and the Fœtus.

Feis (*Archiv für Gynäkologie*, 1894, B. xlvi., H. 1) reports the results of his investigations made on animals. He concludes:

1. That urea has no power to cause uterine contractions, that it is harmless in the body, provided its free excretion is not prevented, though after large injections of solution of urea convulsions followed.

2. Regarding its influence on the fœtus: after injecting the urea and while the mother was more or less convulsed, the uterus was rapidly opened. In each case the young were found dead. The animal was experimented on very near the normal time of birth. A chemical analysis of the fœtal tissues showed urea in excess. In the human female, where there is diminution of the amount of urine, with retention of urea and other urinary substances in the blood, it is probable that besides eclampsia being produced therefrom, the fœtus is poisoned by these materials transferred to it from the maternal blood.

The Etiology and Operative Treatment of Vulvitis Pruriginosa.

Sänger (*Centralblatt für Gynäkologie*, 1894, No. 7), considers pruritus vulvæ to be a symptomatic indication of an inflammation of the vulvar skin and clitoris with involvement of the sensitive nerve-endings. Its causes may be grouped under the heads of endogenous and exogenous. After giving subclassifications of the disease under the above-named heads, the author goes

on to consider the treatment of pruritus vulvæ. In most cases the parts are readily accessible to treatment and the disease is either cured or rendered easily bearable. In some obstinate cases, however, resection of the diseased parts remains as the only resource, though this has obtained very rarely.

The writer cites some cases upon whom operative treatment was used with success, and after describing the measures used, concludes:

1. That partial or total extirpation of the vulva is a thoroughly legitimate operation in chronic incurable cases of the disease, and that it ought to be practised more than it is.

2. The coincident removal of the glans clitoridis and its folds, especially in elderly women, is desirable, as its nerve-endings have already lost their specific sensibility from the disease.

3. In young women, or in cases of circumscribed disease, one can perform a partial operation.

4. In old persons and in extended disease, extirpate all the vulva and make a plastic filling of the space.

The Technique of Artificial Abortion.

Mueller (*Münchener medicinische Wochenschrift*, 1894, No. 4) contributes an article relative to the technique of induced artificial abortion, and narrates the case of a woman, aged forty-one years, of phthisical and rhachitic history. The patient was in her fifteenth pregnancy, having had eight spontaneous labors, one child delivered by forceps, two by perforation, and three by artificial abortion or induced labor. There was some contraction of the pelvic diameters, but not enough to entirely control the case, but intense dyspnœa was present, due partly to malformation of the chest and partly to a large strumous tumor of the cervical glands (cervical goitre).

When coming under the present observation the patient was seven months advanced in gestation. After careful and thorough disinfection of the vagina, 100 grm. of pure sterilized glycerin were injected by means of a catheter and syringe. The patient complained of no special pain, and no escape of glycerin from the os was noticed. Immediately after the injection, violent and obstinate vomiting, accompanied by rigors, and diarrhœa set in. Temperature, 37.8° C.; respirations, 44. After the rigor, pains set in and the temperature rose to 40° C. The intense dyspnœa ceased toward night and the pains and temperature declined also. Later the pains reappeared, and a female child was born. Within a short time there occurred a second rise of temperature, with dyspnœa, and an examination revealed a second bag of waters which was ruptured, and a small dead male child was extracted. From this time the pulse, temperature, and respiration steadily declined to normal, the neck tumor shrinking also. After the injection of the glycerin the urine was red, showing a few blood-corpuscles, but no cylinders. The color was due to methæmoglobin and hæmatoporphyrin. No albumin was present.

In explanation of the repeated accessions of fever, the possibilities of septic infection from the catheter, chemical action of the glycerin, and reflex excitement of the heat-centre through irritation of the peripheral nerve-ends may be mentioned; but as the temperature rise kept pace with the pains, and as these all ceased with the extrusion of each fœtus, the author believes

the cause is to be sought in reflex excitation of the heat-centre through the stimulation of the uterus. The high color of the urine was probably produced by the glycerin.

Sarcoma of the Chorial Villi.

Gottschalk (*Archiv für Gynäkologie*, 1894, B. xlvi., H. 1) contributes an exhaustive article relative to sarcoma of the villi of the chorion. The disease appears some weeks after an abortion, with symptoms of irregular and severe hemorrhages alternating with serous discharges. Recurrent curettage of the uterus gives no permanent relief, but reveals masses of dark-red or brown club-like bodies. These masses are tufts of altered chorion which extend deep into the muscular wall, so that the finger can easily advance through the softened wall, and a curette could easily pass through. It seems as though no musculature remained at the placental spot. Violent cough and extirpation of the uterus is of any use, early operation being necessary. vomiting present themselves, but rarely fever. No treatment save total Immediately after removal of the uterus the cough and vomiting cease, but may later return, and as metatastic growths are found in the brain, this second onset may be cerebral. Foci of disease may also be found in the lungs. Timely removal of the uterus may add six months of comfort to the woman's life. Examination of the uterus after section gives evidence of a very malignant, large-celled new-growth of the placental tufts, involving stroma and epithelium. This rapidly leads to metastatic foci by means of the blood-vessels, these foci agreeing with the primitive formations, and like these they consist of agglomerations of malignant tuft-masses. The diagnosis is based on the microscopic examinations of removed uterine contents. Club-shaped, tailed, or large cells, with giant nuclei that swell under chromatin, and taking the place of the cells of the normal villous stroma, indicate surely this disease. If in a suspicious case *one* of these altered tufts be found, remove the uterus at once.

Intra- and Extra-uterine Fœtation at Full Term; Cæsarean Section.

Franklin (*British Medical Journal*, 1894, No. 1741) reports the case of a woman, the mother of five children, whose history was one of lingering labors. As the patient's condition showed a pronounced state of collapse, the abdomen was immediately opened, and a most interesting condition disclosed. The abdominal wall was as thin as parchment. The uterus presented, and it was noticed that the placental attachment was in the anterior wall, exactly where the incision should be made. On opening the uterus, a full-term, living male child was easily extracted, together with the placenta. After delivery the uterus and appendages were removed. Having secured the uterine stump, it was noticed that a large swelling arose from the pelvic cavity and was accompanied by a free hemorrhage.

On manipulation the tightened capsule of the supposed tumor ruptured, and a dead full-term fœtus was liberated. The child lay with the vertex in Douglas's cul-de-sac behind the stump of the amputated uterus. Great hemorrhage accompanied the delivery of the second child, the blood coming

from Douglas's cul-de-sac, the cæcum, and intestines, to which organs the placenta was attached. The patient lived about half an hour after the operation, transfusion and restoratives being tried in vain.

PÆDIATRICS.

UNDER THE CHARGE OF
LOUIS STARR, M.D.,
OF PHILADELPHIA;
ASSISTED BY
THOMPSON S. WESTCOTT, M.D.,
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EXTREME PROLAPSE OF FEMALE URETHRA IN A CHILD.

BRYANT (*Lancet*, May 12, 1894, p. 1189) reports a case of this kind in a girl of six years. For three years preceding, at intervals of many months, the child had on four occasions suffered from genital irritation, with discharge from the vulva of blood-stained mucus; but, as these symptoms passed off after the lapse of a few days, no professional advice had been sought. The attack reported came on five days before Mr. Bryant saw her, with local genital irritation and straining, which being supposed by the mother to be connected with the bowel, was treated with home remedies. On the third day, as the symptoms had steadily increased in severity and the discharge of blood-stained mucus had become more copious, medical aid was sought, and two days later Mr. Bryant saw the case in consultation. At that time the genital organs were bathed with blood-stained mucus, and between the labia was a cherry-red, blood-oozing, projecting mass about three-quarters of an inch in diameter, and of the same elevation, with a more or less central orifice surrounded by folds of congested mucous membrane, through which a catheter was readily passed into the bladder. Under chloroform the urethra was dilated and the bladder explored by the finger, but with a negative result, and during this operation the prolapsed urethra was reduced. The case subsequently did well.

ACUTE YELLOW ATROPHY OF THE LIVER IN A CHILD.

MERKEL (*Münchener medicinische Wochenschrift*, January, 1894), records an unusual case of this disease occurring in a child of six years. The first symptoms noticed were malaise and loss of appetite, followed by jaundice, the temperature then being normal, but the pulse slightly increased in frequency. The tongue was furred, and the urine contained bile, but no albumin. The lower border of the liver could be felt two fingers' breadth below the costal margin. Eight days later the liver had considerably decreased in size, and could not be felt by palpation. The spleen, however, was enlarged. The jaundice had become intensified, and convulsions now

appeared. The temperature still remained normal, but the pulse had increased to 116. Death ensued seventeen days after onset. At the post-mortem the lungs were found œdematous, while subserous hemorrhages were numerous; the gall-bladder contained very little bile. The liver was very small, yellowish-brown in color, showing a number of red islets; there was gray degeneration of the hepatic cells, with round-cell infiltration in places. The kidneys showed swelling and gray degeneration of the renal epithelium, together with small hemorrhages into the substance. Commencing degeneration of the cardiac muscle fibres was also noted. The cause of the disease, as is usual in such cases, could not be determined.

Parasites in the Feces of Children.

Pagliara (*Il Policlinico*, 1894, vol. i., fasc. 1) has made some interesting observations upon the contents of the feces of infants in good health or presenting digestive disturbances. He examined seventy-four children and adults, and found only twice the trichomonas intestinalis, once in an adult and once in the course of a subacute follicular entero-colitis in a girl of ten months. The child recovered and the parasite disappeared. No pathogenic value can be attributed to these parasites, which have been found also in typhoid and cholera. Cunningham has stated that the trichomonas flourishes only in alkaline media, but the author has found it in stools of neutral or slightly acid reaction.

Amœbæ were not found in the stools of children, but only in those of adults.

Eggs of the common parasites were found to be absent in infants nourished entirely at the breast. In fifty-three cases of children fed artificially, such ova were found in forty-eight cases; eggs of the ascaris, in all; of the trichocephalus dispar in 12.5 per cent., and of the tænia solium in 2.8 per cent. Eggs of the oxyuris and of tænia nana were not found.

Indicanuria: Its Existence in Tuberculosis of Children.

The value of indicanuria as a sign of tuberculosis in children, as advanced by Hochsinger, of Vienna, in 1890, is still a question that seems worthy of further investigation. Kahane, in 1892, published the results of his studies confirmatory of Hochsinger's conclusions, and during the present year additional support has been given by the investigations of Mlle. Lioubitza Djowitch, an abstract of which was recently printed in this department (American Journal of the Medical Sciences, May, 1894, p. 603). On the other hand, Steffen, Voûte, and Carlo Giarre have offered results equally convincing against the diagnostic value of this sign. (See abstract of Voûte's paper, American Journal of the Medical Sciences, July, 1893, p. 123.) Another contribution on the same side may be found in the recently published study of Fahm (*Jahrb. f. Kinderheilkunde*, 1894, Bd. xxxvii., p. 176), who contrasts the results of examinations of fifteen cases of tuberculosis of skin or bones with fourteen cases of other affections, including vulvo-vaginitis, endocarditis, laryngitis, otitis, etc. The method of Jaffé, which was that used by Steffen and Voûte, was employed, though Mlle. Djowitch

criticises the method as unreliable and apt to give a negative result when only small quantities of indican are present.

In the fifteen cases of tuberculosis, among the instances of single focal lesions, normal urine, or that containing but traces of indican, was found in 39.4 per cent., while in the remaining 60.6 per cent. indicanuria was well marked. Very nearly the same figures were found for the cases of multiple lesions, 38 per cent. with normal urine, and 62 per cent. with a well-marked indican reaction. This result contradicts the assertion of Kahane and Hochsinger, that indicanuria is more frequent in the cases of grave or extensive disease than in those where the tuberculosis is slight and limited in extent.

In the fourteen non-tubercular cases indicanuria existed in 40 per cent., and was absent or barely appreciable in the remaining 60 per cent. The proportion is therefore inverse to that found in the presence of tuberculosis. While these figures seem to prove that indicanuria is more frequent in tuberculosis than in other diseases, they add to the evidence against the value of this sign in the diagnosis of tubercular disease. It is to be hoped that studies on a more extensive scale may yet be undertaken to clear up this very interesting question.

Two Cases of Barlow's Disease.

Couitzer (*Münchener medicinische Wochenschrift*, 1894, Nos. 11 and 12) reports two cases under this heading which do not correspond entirely with the classical features of infantile scurvy as described by Barlow and Cheadle.

The first case was a girl of nine months, fed upon raw cow's milk and later upon sterilized milk. For a month the child cried much, especially when touched or taken up. The signs of rhachitis were well-marked; large head with wide fontanelles; the rhachitic rosary; epiphyseal swellings, and absence of teeth. The limbs were swollen, especially along the diaphyses of the bones and in the soft parts, rather than at the epiphyseal ends. The urine was turbid, reddish in color, contained albumin, hyaline casts, leucocytes, and red corpuscles in abundance. The child was put on milk and bouillon; and solution of acetate of potassium with citric acid and Tokay was ordered. Complete cure resulted in a short time.

The second case was that of a boy of eleven months, fed at first on sterilized milk, and later, toward the seventh month, with milk, soups, and *purée* of potatoes. For six weeks the child had been capricious and had cried when put upon the floor, or when the shoes and stockings were put on. Here also there were signs of mild rickets. About the lower incisor teeth, which were alone present, the mucous membrane of the gum was swollen and blue. About the position of the upper incisors, which appeared almost ready to pierce the gum, the mucous membrane was swollen and felt like a little sac. The lower limbs only were swollen and painful to the touch. The urine was very turbid, contained a high percentage of urates and some albumin. Treatment was the same as in the first case, and the cure was rapid. The author attributes the hæmaturia noticed in the first case to the same origin as the other hemorrhages so frequent in this disease. He refuses, however, to recognize Barlow's disease as allied to or identical with scorbutus, because, he

argues, the former is quite frequent; while scorbutus, on the contrary, is very rare; that subperiosteal hemorrhages are constant in Barlow's disease and exceptional in scorbutus; and, finally, that the former can be cured not only by (properly so-called) anti-scorbutic treatment, but also by any sort of tonic treatment.

These reasons seem weak, and are distinctly at variance with the teachings of English and American and most of the German observers. The appearance of the disease in the first case after the use of sterilized milk is confirmatory of the opinion advanced by Jacobi and Starr, in the discussion of Northrup's recent paper before the New York Academy of Medicine (see AMERICAN JOURNAL OF THE MEDICAL SCIENCES, May, 1894, p. 606).

DOUBLE RUPTURE OF THE URETHRA IN A BOY.

MAYET (*Revue mensuelle des Maladies de l'Enfance*, August, 1894, p. 417) records a case of this rare accident in a boy, twelve years and a half old, who, in playing in a gravel-pit, fell a distance of about thirteen feet, landing "astraddle" of an inclined ladder along which he slid to the ground. From the time of the accident no urine was passed by the urethra until his entrance into the Hôpital Trousseau, in the service of Broca, three days after the accident. The symptoms of extensive infiltration of urine were very marked, the scrotum being swollen to the size of the fœtal head, its color black, and skin desquamating, with a spot of gangrene the size of a franc-piece over the median rhaphe. The penis was greatly swollen, and the prepuce œdematous. The infiltration also extended well down the thighs and up over the abdomen.

An incision was made in the median rhaphe of the scrotum and carried down to the urethra. A complete rupture was found at the level of the superior third of the anterior face of the symphysis. With some difficulty the posterior portion of the urethra was found, and a catheter passed into the bladder, from which 200 grm. of urine were drawn off. The instrument was fastened in position, the anterior extremity being introduced through the anterior portion of the urethra. Free incisions were made into the infiltrated areas, the wound in the scrotum disinfected, and a wet dressing applied. Death occurred six hours later in collapse.

At the autopsy intense pulmonary congestion was found, the other organs and the peritoneal cavity being healthy. The rupture found during life was located in the bulbous portion 5 cm. behind the root of the penis. One centimetre behind the posterior portion of the rupture was a second break, incomplete and involving only the postero-inferior face of the canal, its edges torn, and the orifice, one centimetre by five millimetres, having its greater diameter along the axis of the urethra.

This observation is interesting both because of the rarity of urethral rupture in children, and because multiple ruptures are rare even among men. In falls astraddle, the urethra is usually ruptured in but one place, the canal being pressed against one or other of the ischio-pubic branches. In the author's case the first rupture was situated over the anterior aspect of the symphysis, and must have been made by falling, not astraddle, but almost in a line parallel with the sides of the ladder. The second rupture, he thinks, occurred by the usual mechanism during the slide to the foot of the ladder.

Hereditary Tuberculosis and Early Infection.

Instances of direct infection of the fœtus *in utero*, from a tuberculous mother, are on record, but the number is as yet small. Such observations have been made by Charrin, Merkel, Berti, Rindfleisch, Aviragnet, Jacobi, Labourand, and a few other writers. Recent literature has made several additions to the list. Cnopf (*Münchener med. Wochenschrift*, 1893, Nos. 39 and 40) records an autopsy upon a child of twelve weeks, born of tuberculous parents, which, at birth exhibited atrophy, anasarca, and jaundice. Miliary tuberculosis of both lungs, caseous peri-bronchitis, caseation of the bronchial glands, and tuberculosis of the spleen were found at the post-mortem. Two years later another infant of the same family, born apparently healthy, died athreptic in the thirty-fifth week after birth. The autopsy revealed caseation of the bronchial glands, purulent bronchitis, intestinal tuberculosis with caseation of the mesenteric glands. Another case dying at the age of sixty-three weeks, showed extensive ravages in the lungs that must have begun at a very early date. The lungs were filled with large cavities, one of which was the size of a man's fist. The bronchial glands, spleen, mesenteric glands, and intestinal mucous membrane were very extensively diseased.

Two cases recorded by Goldschmidt (*Munchener med. Wochenschrift*, 1893, No. 52) may be added, and are extremely interesting as showing the probable course of infection directly from the placenta. The first, an infant of fifteen months, whose parents were tuberculous, was received into the hospital for a cough of long duration, with advanced cachexia. Autopsy showed a tuberculosis of the lungs, of the bronchial, mediastinal, and mesenteric glands; on the lower surface of the liver, at the point of insertion of the umbilical ligament, was a nodule containing tubercle bacilli. The other organs were not diseased. In this case the author believes that the existence of a tubercle at the extremity of the ligament which enclosed the umbilical vein clearly points to infection of the fœtus by the blood of the mother, though the possibility of accidental infection after birth by way of the healing umbilicus must cast some doubt upon this view. The second case was very like this one. The child was seven months old, and the lesions found were advanced pulmonary tuberculosis, glandular involvement, tubercular ulceration of the intestine, and a tubercular focus in the liver at the insertion of the umbilical ligament. While the pulmonary disease was more advanced than that of the liver, the author thinks, in consideration of the site of the hepatic lesion, that this had been the focus of primary infection. Another case is recorded by this writer, in which extensive lesions were found in a child of five weeks, removed from the tuberculous mother within a few hours after birth, the mother dying shortly after. In this case intra-uterine infection seems most probable.

Boullaud (*Journal de Méd. et de Chir. prat.*, 1894, No. 21, p. 824) draws attention to a possible avenue of infection at the moment of birth. During the progress of the fœtal head the external auditory canal may become filled with maternal blood, and this may very quickly become the seat of a tubercular suppurative otitis from which a generalized infection may spread to the organism. As a prophylactic measure he suggests a disinfection soon after birth of the auditory canals of infants born of tuberculous mothers.

Onset of Scarlatina with Acute Urticaria.

Coulon (*La Médecine Infantile*, February 15, 1894) records the case of a delicate girl, of five years, of syphilitic parentage, who was suddenly seized with headache, high fever, delirium, and intense itching of the whole surface. The next morning there was a typical scarlatinal rash and angina. Three hours after the physician's visit the eruption had changed, being apparently replaced by an urticaria with intense itching. By evening this rash had begun to disappear, and the scarlatinal eruption became more manifest. The disease ran the course of ordinary scarlatina without albuminuria. Previous to the appearance of the urticaria there had been no change in diet and no drugs had been given.

HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF

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AND

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The "Hermite" Process.

Two years ago the London County Council offered facilities for the experimental treatment of a certain amount of sewage by electrolysis, a method proposed and patented by Mr. Webster.

In it the sewage was made to flow through channels in which were large iron plates or electrodes connected with a powerful dynamo. It was, however, essentially a chemical process, the sewage matters being more or less completely broken up by the action of compounds of the nascent oxygen and chlorine evolved at the positive pole, while the iron in solution served to fix the sulphur of the H_2S, and acted as a carrier of oxygen by alternate reduction into ferrous and reoxidation into ferric oxide.

This year the Town Council of Worthing have entertained in like manner M. Hermite, a French chemist, who having been engaged in the production of bleaching liquids by electrolysis had applied the same methods to the conversion of sea-water into a disinfectant fluid, deodorant and germicide.

His electrolyzing apparatus consists of rows of vertical iron rods sheathed below in a meshwork of platinum wire, and between each row a circular zinc disk revolving by connection with the machinery that works the dynamo, the whole contained in a metal reservoir through which the sea-water is conducted.

The effect of the current passing from the zinc to the platinum is to break up the magnesium chloride, but this action is followed by a rearrangement of the elements and the formation of magnesium hypochlorite. The sodium

chloride is not decomposed, and some of the far less stable magnesium chloride remains unchanged. M. Hermite calculates that with a motive force of twelve-horse power he can obtain from each electrolyzer 1 kilogramme of chlorine per hour, which would be equal to 48 cubic metres in twenty-four hours of the fluid of a strength of 0.5 gramme of chlorine per litre, or of 96 cubic metres with 0.25 gramme Cl.

The fluid has no odor of chlorine, appears neutral in reaction, it bleaches litmus and vegetable colors, and destroys the odor of H_2S instantaneously, liberates iodine from potassium iodide, and raises the lower metallic oxides to the higher.

It attacks pure iron and zinc, though feebly, and soon covers the internal surfaces of tanks and pipes with a protective coating of impure magnesium oxide; but unfortunately it speedily destroys leather and India-rubber in fittings.

It is very stable when kept alone or diluted with distilled, tap, or even artificial sea-water; but rapidly loses strength when mixed with ordinary sea-water, probably through its action on the organic matters present therein for the most part in suspension.

The Commissioner of the *Lancet* added to 50 cubic centimetres of electrolyzed sea-water, or Hermite's fluid, quantities varying from 1 to 300 cubic centimetres of a one in fifty, *i. e.*, two per cent., dilution of urine containing originally 4.18 per cent. of solids, with the curious result that the residual chlorine estimated at the end of fifteen minutes was the same—viz., 0.24, or half the original 0.5 per cent.—whether the dilute urine added were 10 or 300 cubic centimetres, and the same limit was observed when culture broths or gelatins were substituted for the urine.

During the reaction there appears to be a temporary liberation of chlorine.

As to the precise nature of the active constituent of his fluid M. Hermite expresses himself in a very guarded manner, describing it as an "oxygenated compound of chlorine;" it has been looked on as magnesium hypochlorite, analogous to, though even more unstable than, the calcium hypochlorite contained in bleaching-powder; but many facts, reactions, and peculiarities exhibited in its behavior would rather point to a subsequent breaking up of a part of the magnesium hypochlorite into the hydric salt, or hypochlorous acid, as it is commonly called.

One understands, then, the loss of MgO after electrolysis, amounting to 10.5 per cent. of the whole, or to 22.5 per cent. of that present as magnesium chloride in the original sea-water, as well as the source of the precipitate of magnesium hydrate in the tanks and pipes. The hydrochlorite apparently gives up its oxygen to organic matter, leaving a solution of chlorine which acts, though more slowly and indirectly, in like manner.

This view is strengthened by the strong contrast presented by the reactions of Hermite's fluid and of a solution of calcium hypochlorite; and the almost identical behavior of a solution of hypochlorous acid obtained by passing CO_2 through a solution of bleaching-powder in water. Solution of bleaching-powder is distinctly alkaline, bleaches slowly, gives up little of its chlorine to printed and still less to clean paper; mixed with dilute urine it gives up nearly all its available chlorine, but emits a very slight odor of that gas; it loses little chlorine by dilution with common or artificial sea, fresh, or dis-

tilled water, does not blacken mercury, and yields *in vacuo* a distillate having no bleaching property.

Electrolyzed sea-water and a solution of hypochlorous acid of the same strength are neutral to litmus paper, which they bleach instantaneously; they yield up nearly all their chlorine to printed and about 30 per cent. to clean paper; half their available chlorine to dilute urine, evolving at the same time a strong smell of chlorine; the greater part of their chlorine to ordinary sea-water, but only a very small fraction to artificial salt-water, to fresh, or to distilled water; they instantly blacken mercury, and their distillates are powerful bleaching agents.

M. Hermite proposes bringing the electrolyzed water into the houses of a town, like gas and water; he thinks that if supplied only to water-closets at the rate of two gallons for each flush it would not cost for a town like Worthing more than sixpence per head, and that for a shilling a further supply might be provided for washing floors and yards, flushing gulleys or drains and disinfecting purposes generally. His arrangement is to fix in the siphon trap of each closet a wire basket or sieve in which fecal matters are arrested, exposed to the action of the electrolyzed fluid, and, as he asserts, disintegrated and destroyed—but this is not the case. The effluent might be sterile and the contents of the basket free from odor, but Dr. Ruffer found that the fluid exerted no greater disintegrating action than ordinary water; and the baskets, if not frequently removed and emptied, soon became choked. This single difficulty, if not overcome, is enough to absolutely preclude the general adoption of the system.

Another practical difficulty would be presented by the action of paper, soap-suds, fatty, starchy, and others matters contained in domestic slops in rendering the fluid inert before it had time to act on the fecal matters. These conditions and results were indeed found in one of the yards at Worthing, which M. Hermite refuses to recognize as a fair exhibition of his process, but which many would consider to represent it under the working conditions that would be met with in any ordinary town.

Dr. Ruffer found that when the fluid contained only 0.5 gramme per litre of the chlorine, the strength which M. Hermite holds to be sufficient for all practical purposes, it was very unstable, losing 90 per cent. within the first twenty-four hours. Such a strength was consequently useless, but the stability increased with the proportion of chlorine present. A liquid containing 0.75 gramme lost 34 per cent. on the first day, and one with 1 gramme only 8 per cent. But the amount or duration of the current to produce a solution of 0.75 gramme has to be double, and to obtain 1 gramme per litre has to be four times, that required to give 0.5 gramme.

Again, whatever the strength of the solution, it does not dissolve or disintegrate the solid fecal masses, the interior of which it fails to sterilize; although, until the particles are broken up, they are completely deodorized. It deodorizes and sterilizes foul fluids if it be added in something like equal volume, but in the case of town sewers this would obviously be impracticable.

In short, after a careful study of Dr. Ruffer's preliminary report and of the exhaustive chemical and bacteriological researches undertaken by the *Lancet* Commissioner, as well as an inspection of the works, the conclusion seems irresistible that M. Hermite has discovered a useful disinfectant for

certain purposes and places; but that, however interesting the laboratory experiments or even those exhibited at the show station may be, the system is but one more of the ingenious but unworkable schemes proposed by chemists which engineers cannot entertain unless perhaps in the case of single houses or establishments.

Concurrent Infection.

Since Hunter taught that "all morbid processes were simple" it has been generally held that the actual presence of one acute specific disease conferred for the time being some degree of protection against others. The experience acquired of late years in fever and smallpox hospitals—especially the frequency with which the attempt to treat smallpox cases within the same curtilage as scarlatina and other fevers, has been followed by the intercommunication of infection, at any rate of smallpox to the fever blocks—has shown pretty conclusively that the mathematical doctrine of probabilities is amply sufficient to explain why two or more diseases, each occurring as a rule but once in a lifetime, do not more often attack a man at one and the same time.

Many pathogenic organisms will grow together in a culture, and there is no reason why they should not in the living body.

Dr. Caiger gave, at a recent meeting of the Epidemiological Society, an interesting analysis of his own experience of four years as the Superintendent of the Stockwell Fever Hospital, and an analysis of the like cases in the other hospitals of the Asylums Board. He had seen 362 cases of two, and 17 of three such diseases running a part at least of their courses concurrently; and in 200 of these the febrile stages of two or three actually coincided. The relative priority of the diseases he calculated from the date of infection, as determined by the appearance of the eruption and the known duration of the incubation; for the eruptions would not always follow the order of infection, *e. g.*, scarlatina contracted any time within a week after an infection with measles or varicella would show itself before either of these.

Of course, the grouping of the diseases depended mainly on their age, incidence, and seasonal prevalence, as well as on their actual frequency; but the question of the modifying influence, if any, exerted by one disease on another was of far greater practical importance, and the conclusions at which Dr. Caiger arrived were: (1) that neither the incubation periods nor the essential phenomena of the diseases were in any way altered, but that (2) one involving considerable constitutional disturbance aggravated that which followed in order of appearance, and those attended with inflammation or hyperæmia of any surface or tissues intensified subsequent diseases which were specially located in those structures. Hence post-scarlatinal diphtheria was worse than scarlatina after diphtheria; but diphtheria following on measles was even more fatal, from its constant extension to the congested air-passages. Varicella had not the slightest influence on any subsequent disease, but when it made its appearance on the hyperæmic skin of a patient suffering, or even convalescing, from scarlatina the eruption and intensity of the disease might rival that of unmodified smallpox.

Of the 48,376 cases of scarlatina admitted into the hospitals of the Board

in the last six years, 3166, or 6.54 per cent., were complicated with some other acute specific, which in 1094 cases was diphtheria. The great frequency of this complication was easily understood when one reflected on the favorable conditions presented by the throat, during or shortly after scarlatina, for the reception of the diphtheritic bacillus, and the fact that one attack of diphtheria, so far from conferring immunity, tended rather, by the unhealthy state of the fauces that often persisted, to render the individual more susceptible than others to infection.

Vaccine and Glycerin.

The dilution of vaccine lymph with a certain proportion of glycerin has long been practised, especially under the pressure of epidemics and panics, with a view to render a limited supply available for the vaccination of a large number of persons.

Its use in moderation was not found to impair the activity of the lymph, while it presented the advantage of preventing the drying up of the lymph during the prolonged exposure unavoidable under such circumstances, and the procedure was looked on as a harmless sort of adulteration, quite justifiable, though not to be commended in itself.

But Dr. Monckton Copeman in his researches on vaccinia, having satisfied himself that the well-known cloudiness that appears in lymph stored in capillary tubes was due, not to coagulation, but to the rapid growth of extraneous aërobic organisms, originally present in the lymph, though in inappreciable numbers, and that they not only caused the progressive deterioration of the lymph by crowding out the specific microbes, but in some cases, at any rate, gave rise to the irregular, excessive, and erysipelatoid inflammations that occasionally followed on vaccination, even when no subsequent infection of the wound from without could be established, turned his attention to this property of glycerin, and with results of the highest practical value. He found that lymph was actually improved by the addition of an equal volume of a 50 per cent. solution of glycerin in sterilized water, not merely remaining perfectly clear and fluid for an indefinite time, but positively gaining in activity for six months at least.

It would appear that, though no purely artificial culture medium has as yet been discovered, there is no necessary tendency to extinction of the microbes in pure cultures in the natural serum so long as the access of air and of foreign micro-organisms is excluded, and that the glycerin, by inhibiting the growth of the latter, permits the proliferation of the proper microbe and the accumulation of their products to go on unchecked; and this is a necessary step in the direction of their isolation and culture under artificial conditions. It is true that their very existence is hypothetical, that they have hitherto eluded, and may indeed forever continue to elude our vision; but this is merely a question of magnitude.[1] If they be as much smaller than those of tubercle or of anthrax as these are than the torulæ, it is possi-

[1] Since writing this I have heard that Dr. Copeman has demonstrated the presence in a number of samples of absolutely pure lymph of an extremely minute and hitherto unrecognized bacillus, which can scarce be other than the object of his search, although up to the present he has failed to cultivate it in artificial media.

ble that no magnifying, illumination, or staining will ever suffice for their recognition; but our belief in the specific nature of pathogenic microbes, whether or not confirmed by ocular demonstration, rests rather on the constant results of inoculation experiments, without which we could not positively assert their causal connection with the several diseases, although they might be invariably present.

If the perpetuation of the vaccine lymph in an active state out of the body of man or beast, for which the Grocers' Prize of £1000 was offered, should be achieved, one objection urged by the opponents of vaccination would be removed; but we are already greatly indebted to Dr. Copeman for showing how lymph may be preserved for months absolutely free from any deterioration or enfeeblement.

Citric Acid in the Local Treatment of Diphtheria.

Most suggestions for the local treatment of diphtheria have been consciously or unconsciously based on the now well-established fact that the throat affection, which in scarlatina is simply one local manifestation (the rash being another) of a general disease, is in diphtheria the indication of the recent invasion of that particular mucous surface by the bacilli, which do not extend beyond the immediate vicinity of the cervical glands at the farthest, though diffusing thence a poison, as Roux and Yersin have shown; or more accurately, according to Hunter, a ferment that generates the poison to which the general and nervous phenomena are due. To destroy the bacilli on their first landing, as it were, before they have had time to intrench themselves in the deeper tissues, is the aim of such treatment; and the local application of germicides, among which the strong caustics, mineral acids, perchloride of iron, etc., of the older practitioners must be included, as well as the mercury iodide and the eucalyptus oil of Illingworth and Curgenven respectively, has been productive of more or less encouraging results in lessening the subsequent general infection.

Dr. Hugo Laser, assistant in the Hygienic Institute of Königsberg, considering the difficulty of applying caustics in children, and fearing that any injury to the mucous membrane by the use of stiff brushes or otherwise might actually assist the entrance of the bacilli into the submucous tissues, proposed to try citric acid in solutions that should be astringent rather than caustic. Espine and De Marignac had shown that salicylic and citric acids and lemon juice destroyed both the false membrane and the bacilli [boric acid, alum, and potassium chlorate being quite useless], and Abadie used it in strong, almost caustic, solution every five hours at first, and every eight to twelve later on. Babès had treated cultures in various ways with a number of established or reputed germicides, of which, under all circumstances, sublimate proved the most active, potassium permanganate far better than one would have expected, and citric, lactic, and acetic acids fairly satisfactory.

Laser confined his attention to citric acid and lime juice (citric acid, $\frac{7}{8}$ per cent.; sugar, etc., $\frac{3}{4}$ per cent., and salt, 2 per cent.), varying his experiments in every way as regards the strength of the acid, the frequency, duration, and mode of its application, and the nature of the culture medium. He next treated portions of diphtheritic membrane by dippings and washing, and last

of all he applied the results in actual clinical practice, using frequent applications, with a full camel's-hair brush, of a 5 to 10 per cent. solution, which, diluted in the proportion of one tablespoonful to a glass of water, he used as a gargle and also internally, the dose in the latter case being from one or two teaspoonfuls for a young child, to a tablespoonful or more for an adult every hour or two.

Raw lemons, in thin slices, should at the same time be eaten, or rather sucked, one or two per diem, or the expressed juice drunk as lemonade.

He does not pretend to have found a specific, but states that of fifteen cases thus treated, some of them with very severe and extensive exudation, fourteen were cured within three days. The only fatal case was that of a child, in which the tonsils, uvula, and nares were involved, streptococci were abundant, and death was brought about through septic infection.

Seventy cases of angina, and twelve in which the diagnosis of diphtheria was doubtful, were treated in like manner, and all recovered in a couple of days.

Detection of Tubercle Bacilli in the Sputa when Present in Very Small Numbers.

Under such circumstances, and with the usual methods of staining, they may escape detection, and Dr. Guttersack recommends:

1. Steeping for twenty-four hours in a very dilute solution of potassium permanganate.
2. Decolorizing by a few seconds' immersion in a 1 or 2 per cent. solution of hydrochloric acid with about 50 per cent. of alcohol.
3. Five minutes' immersion in a concentrated watery solution of potassium bichromate, and,
4. Examination in glycerin, terebene, and monobrom-naphthalene.

The bichromate brings out in clearer definition the outlines of the mucous corpuscles and the cells, and gives to the latter a delicate greenish-yellow hue.

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